CHEVREUL ON COLOURS

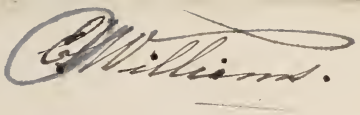


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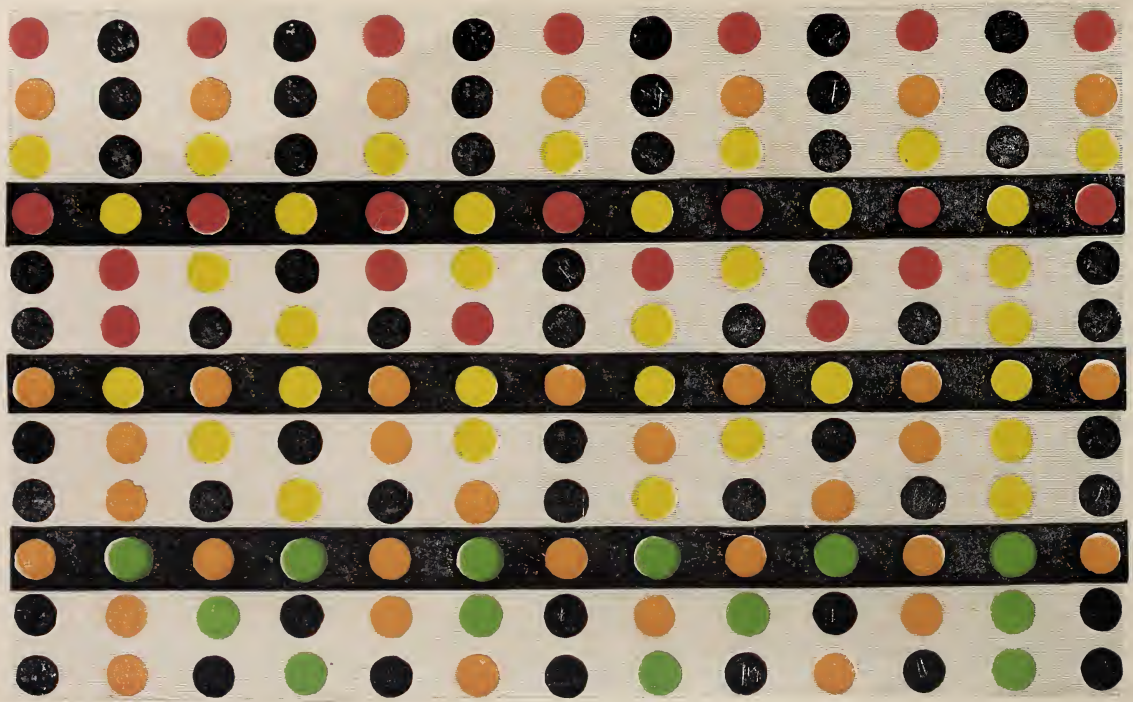


PLATE IX.

THE LAWS

OF

CONTRAST OF COLOUR:

AND THEIR APPLICATION TO THE ARTS

OF

PAINTING, DECORATION OF BUILDINGS, MOSAIC WORK, TAPESTRY AND CARPET WEAVING, CALICO PRINTING, DRESS, PAPER STAINING, PRINTING, MILITARY CLOTHING,

Illumination, Landscape, and Flower Gardening, &c.

By M. E. CHEVREUL,

DIRECTOR OF THE DYE WORKS OF THE GOBELINS, ETC. ETC.

TRANSLATED FROM THE FRENCH BY

JOHN SPANTON.

NA
1488
C52
1861

NEW EDITION,

With Illustrations printed in Colours.

LONDON:

ROUTLEDGE, WARNE, AND ROUTLEDGE,

FARRINGDON STREET.

NEW YORK: 56, WALKER STREET.

1861.

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ENGRAVED AND PRINTED IN COLOURS BY EDMUND EVANS.

In referring to the illustrations, it will be necessary to cover with white paper all but the example immediately under notice.

Note.—In Plates 8, 9, and 10, the examples are in rows of 13 circles arranged lengthwise.

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PREFACE

TO THE

THIRD EDITION.

THE present edition has been entirely revised; some obscurities cleared up, and a chapter on Military Clothing added. The application of Chevreul's reasoning will doubtless tend to a rational view of this much debated question. It affords much satisfaction to all concerned in the diffusion of the principles enunciated in this work, to observe that they are being generally applied in this country, thus realizing the hopes originally expressed by the translator.

TRANSLATOR'S PREFACE.

Colour, a universal source of enjoyment, so essential an element of decorative art, has not been hitherto the subject of such investigations as to place its powers, harmonies, and discordances among matters of scientific certainty. A few traditionary dogmas have been the only guide of ordinary workmen, while success in design, as well as in the higher regions of art, has been dependent upon that rare union of faculties vaguely denoted by the indefinite, unsatisfactory term, "taste."

The arrangement of colours in manufactures of English design—since the decline of mediæval art—has commonly been condemned as notoriously arbitrary, destitute of any reference to principle, and deficient in that satisfying richness and beauty which result from harmonious combinations. Although often overcharged with colour, and of costly elaboration, our manufactures have too often proved that the designer—in ignorance of a true, infallible standard—has mistaken gaudiness for splendour, and capricious strangeness for improvement; and, for want of a better claim to popular favour, has constantly sought it by "leaning on novelty, his fickle, frail support."

The established preference of French designs was shown, by the Great Exhibition of 1851, to be, in the main, well founded ; and one of the leading causes of the perfect success of some objects was found in the fact, that they had been designed and executed in accordance with a well-defined set of principles, extensively taught in France to designers, workmen, and others. These principles it is the purpose of this book to set forth, to illustrate, and to apply to every art of which the choice and arrangement of colours is an element.

The author, M. Chevreul, before the publication of this work, had gained high reputation by his researches in organic chemistry. In his "Considérations sur l'Analyse Organique," he enunciated principles which, carried into practice in his "Recherches sur les Corps Gras d'origine animal," opened the path which has been rendered illustrious by Liebig and others. But, being appointed Director of the Dye Works of the Gobelins, he was compelled to abandon these researches—the field in which, "having sown, he had, as it were, only to reap,"—that he might fully investigate the principles involved in the assortment of colours.

M. Chevreul's earnest attention to this inquiry was continued during ten years, with ample opportunities for investigation. For twenty-five years he has been in the habit of lecturing to workmen, artists, &c. The undisputed superiority of those French manufactures in which these instructions have been fully carried out, has evinced his success and rewarded his exertions.

Aware of the important influence of such knowledge,

the Chamber of Commerce of Lyons solicited and obtained from the French Government permission for M. Chevreul to lecture there to the artisans especially, to whom printed copies of the lectures were afterwards gratuitously distributed.

As the present Work contains the substance of these instructions, we may hope that our own industrious countrymen may not long be without a similar advantage.

The value of this book has been universally recognised, and it has already been translated into several languages, although but recently into our own. A recent critic has said, with equal truth and eloquence, —"Rarely has a subject of inquiry, so fraught with beautiful and ready applications, been presented to us. To be familiar with this book is to possess a new sense. Every object in art and nature speaks a new and exciting language. Colour becomes music to the eye. We become impatient of any violent infringement of the principles of harmony, and seek every opportunity of putting our newly-acquired knowledge into practice. The minuteness of investigation, and the copiousness of illustration which characterize this volume are truly remarkable; the most untutored mind cannot fail to understand it, if steady attention be given. As a preparation for a course of scientific study, it is invaluable, for it is an excellent example of the Baconian method of investigation."

EXTRACTS

FROM

THE AUTHOR'S PREFACE.

In seeking to discover the causes of the complaint made of the quality of certain colours prepared in the dyeing laboratory of the Gobelins, I was at once convinced, that, although the complaints concerning the instability of the light blues, greys, and browns, might be well founded, there were others, especially those of a want of vigour in the blacks employed for the shadows of blue and violet draperies, which were not so; for, having procured black-dyed wools from the most celebrated dye-works in France and other countries, and having found that they were not superior to those of the Gobelins, I saw that the want of vigour alleged against the blacks was owing to the colours contiguous to them, and that the matter was involved in the phenomena of *the contrast of colours.*

It was thus demonstrated to me that I had two absolutely distinct subjects to investigate, in order to fulfil my duties as Director of the Dye Works; the first being the contrast of colours, considered in the most general manner, both in relation to science and to

its applications: the second—the chemistry of dyeing. These are the two centres around which have converged all my researches during the last ten years.

In fact, numerous observations made during several months, on the view of coloured objects, which were verified by my pupils and others, much accustomed in their profession to judge of colours and to appreciate the least differences between them, have been collected and described as well-known facts. Upon reflecting on the mutual relations of these facts, and in seeking the principle of which they were the results, I was led to the discovery of that which I have named the "Law of Simultaneous Contrast of Colours." Thus this work is the fruit of the method *à posteriori:* facts are observed, defined, described, then generalized in a simple expression, which has all the characters of a law of nature. This law, once demonstrated, becomes a means, *à priori*, of assorting coloured objects so as to obtain their best possible effect, according to the taste of the person who arranges them; it becomes also a means of estimating whether the eyes are well organized for seeing and judging of colours; and whether painters have copied exactly the colours of known objects.

In reviewing the Law of Contrast with regard to its application, and in submitting to experiment all the laws which appear to me to result from it, I have been led to extend it to the arts of tapestry, to the various sorts of painting and printing, to illuminating, horticulture, &c. But, in order to anticipate the judgments of some readers, upon the value of the opinions I have advanced (2nd part, 2nd division) respecting the Gobelins and Beauvais tapestry and the Savonnerie

carpets, I must state, that, being an entire stranger to the inspection and direction of the works which are executed in the Royal manufactories, as well as to the choice of models, my views and opinions should be regarded only as those of an individual who has had frequent occasion to see and examine various artistic productions, on the preparation of which he could exercise no influence, the duties which attach me to the Gobelins being exclusively those of Director of its Dye Works.

THE LAWS

OF

Harmony and Contrast of Colours.

INTRODUCTION.

1. A RAY of solar light is composed of an indeterminate number of variously coloured rays, which are distributed into groups, termed *red rays, orange rays, yellow rays, green rays, blue rays, indigo rays, violet rays.*

2. But all the rays comprised in the same group, the red for example, are not identical in colour; on the contrary, they may be considered as differing more or less among themselves, although we recognise the impression they produce separately, as comprised in that which we ascribe to red light.

3. When light is reflected by an opaque white body, it is not modified in proportion to the variously coloured rays which constitute white light; but, 1. *If the body is not polished,* every point of its surface is to be considered as dispersing the white light which falls upon it, in all directions, into the surrounding space; so that the point becomes visible to an eye placed in the direction of one of its rays. We may easily conceive that the image of the body, in a given position, is composed of the sum of the physical points, which send to the eye so placed, a portion of the light which each point

radiates. 2. *If the body is polished,* as, for example, the surface of a mirror, a portion of the light is irregularly reflected, as in the preceding case; while another portion is regularly reflected, giving to the mirror the property of presenting to an eye, suitably placed, the image of the body which sends its light to the reflector. One consequence of this distinction is, that if we regard two plane surfaces which reflect white light, and differ from each other only in polish, it will happen that where the unpolished surface is visible, all its parts will be equally, or almost equally, illuminated; while the eye, when in a position to receive only the light which it reflects irregularly, will receive very little light from the polished surface; but it will receive much more light when in a position to receive that which is regularly reflected.

4. If the light which falls on a body is completely absorbed by that body, so that it disappears from sight, as in falling into a perfectly dark cavity, then the body appears to us black; and it becomes visible only because it is contiguous to surfaces which reflect or transmit light. We know of no bodies which are perfectly black, and it is only because they reflect a little white light that we judge they have relief, like other material objects.

5. When light is reflected by an opaque coloured body, there is always a reflection of white light, and a reflection of coloured light; the latter is owing to the fact that the body absorbs or extinguishes within itself some of the coloured rays, and reflects the others. It is evident that the *absorbed* coloured rays are of a different colour from the *reflected* coloured rays; and farther, that if these be reunited with the former, white light will be reproduced. It is evident, also, that unpolished opaque

bodies reflect irregularly white light, and the coloured light which makes them appear coloured; and that those which are polished reflect irregularly a portion only of these two lights, while they reflect regularly the other portion.

6. It thus appears, by what has been said concerning the physical composition of solar light, that if the whole of the coloured light which is absorbed by a coloured body were reunited with the whole of the light which it reflects, white light would result. Now, it is this property of two variously coloured lights, taken in a certain proportion, to reproduce white light, that we express by the words *coloured lights complementary to each other*, or *complementary colours*. It is in this sense that we say,

Red is complementary to Green, and *vice versâ*.
Orange „ „ Blue, „ „
Greenish Yellow „ Violet, „ „
Indigo „ „ Orange Yellow, „

7. It must not be supposed that a red body, a yellow body, &c. reflects, besides white light, only the red rays or yellow rays, &c., each of these bodies reflects also every sort of coloured rays; but, the rays which cause us to judge it to be red or yellow, &c., being more numerous than the others, produce more effect than they; yet, the latter have an undoubted influence in modifying the action of red and yellow rays upon the organ of sight. This explains the innumerable diversities of colour observable among various red bodies, various yellow bodies, &c. It is difficult not to admit that among these diversely coloured rays reflected by bodies, there are a certain number which, complementary to each other, must reproduce white light upon reaching the retina.

PART THE FIRST.

SECTION THE FIRST.

OF THE LAW OF SIMULTANEOUS CONTRAST OF COLOURS, AND OF ITS DEMONSTRATION BY MEANS OF EXPERIMENT.

CHAPTER I.

Manner of observing the Phenomena of the Simultaneous Contrast of Colours.—Definition of Simultaneous Contrast.

8. If we look at the same time at two stripes of unequal tints of the same colour, or at two stripes of equal tints of different colours, in juxtaposition, that is to say, contiguous by one of their edges, the eye will perceive, if the stripes be not too wide, certain modifications; in the first case affecting the intensity of the two tints, in the second, the optical composition of the two colours so placed. Now as these modifications cause the colours to appear, when looked at together, more different than they really are, I have given to them the name of the *simultaneous contrast of colours.* The modification which affects the intensity of colour, I term *contrast of tone;* and the modification which affects the optical composition of the contiguous colours, I term *contrast of colour.*

The twofold phenomena of contrast of colour and contrast of tone may be readily shown by the following

Experimental Demonstration of Contrast of Tone.

Plate A A′.

9. Let the two halves of a sheet of unglazed paper, about twenty inches square, be coloured clear grey, by a

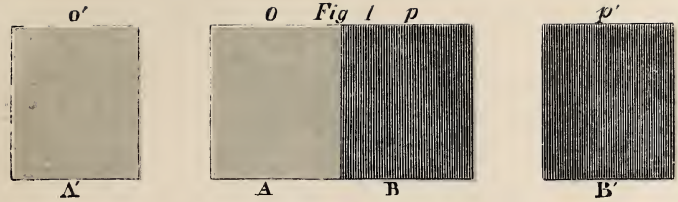


Fig. 1

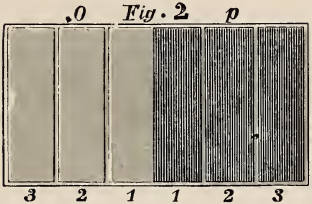


Fig. 2

Fig 3

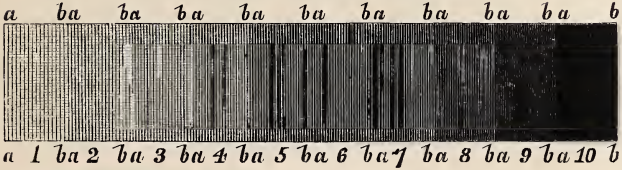




Fig 4

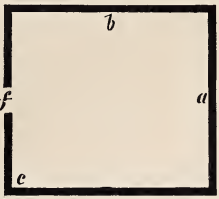


Fig. 5



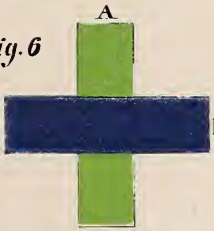


Fig. 6

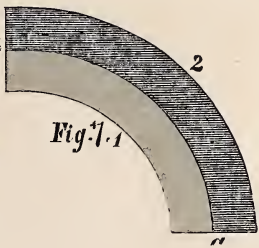


Fig. 7.

PLATE I.

mixture of chalk and black; fix them, in any way, upon a piece of unbleached linen, placed across a window, at the distance of twelve inches asunder. Take two halves of another piece of similar paper B B′, but of a darker grey, and coloured with the same substances. Fix A next to B and place B′ twelve inches from B. (See Fig. 1.)

Upon looking at the four half sheets for a few seconds, it will be seen that A contiguous to B will be lighter than A′, while B will seem darker than B′.

10. It is easy to demonstrate that the modification is not equally intense over the whole of the surfaces A A′ and B B′, but that it becomes gradually feebler from the line of contact. This may be proved by placing a card, so cut, that O and P may each present three grey stripes, as shown in Fig. 2, Plate 1. The stripes 1 1 are more modified than the stripes 2 2, and these are more so than the stripes 3 3. However, in order that this modification may be effected, it is not absolutely necessary that O and P should touch; for if the stripes 1 1 be covered, the stripes 2 2, 3 3 will be modified.

11. The following experiment, which is simply the result of the two preceding (9 and 10), is well suited to demonstrate the extent of contrast of tone. Upon a sheet of cardboard divided into ten stripes, each about a quarter of an inch broad, lay a uniform tint of Indian ink. As soon as it is dry, lay a second tint on all the stripes except the first. As soon as the second is dry, lay a third on all the stripes except the first and second, and so on of all the rest, so as to have ten flat tints, gradually increasing in depth from the first to the last. (See Fig. 3.) If ten strips of paper of the same grey, but each of a different tone, be laid upon a cardboard, in the preceding gradation, it will serve the same purpose.

Upon looking at the cardboard, it will be seen that the strips, instead of presenting flat tints, will each appear of a tone diminishing in intensity from the edge *a a* to the edge *b b*. In the stripe 1, the contrast is produced simply by the contiguity of the edge *b b* with the edge *a a* of the stripe 2; in the stripe 10, it is simply by the contiguity of the edge *aa* with the edge *bb* of the stripe 9. But in each of the intermediate stripes 2, 3, 4, 5, 6, 7, 8, 9, the contrast is produced by a double cause; partly by the contiguity of the edge *aa* with the edge *b b* of the stripe which precedes it, partly by the contiguity of the edge *bb* with the edge *aa* of the darker tint which follows it. The first cause tends to raise the tone of the half of the intermediate stripe; while the second cause tends to lower the tone of the other half of the same stripe.

In consequence of this contrast, the stripes seen from a proper distance, resemble channels rather than flat surfaces. For, in the stripes 2 and 3 for instance, the grey is weakened from the edge *a a* to the edge *b b*, presenting to the eye the same effect as if the light fell upon a channelled surface; there is however this difference, that in the real channelling the enlightened part would throw a reflection upon the dark portion.

12. Contrast of tone occurs with colours so called as well as with grey; thus to repeat the experiment (9), fig. 1, with the halves *o o* of a sheet of paper of a light tint of a certain colour, and the two halves *p p* of a sheet of paper of a darker tint of the same colour, it will be seen that *o* contiguous to *p* will be lighter than *o'*, and *p* darker than *p'*. In short, it may be demonstrated as has been done (10) that the modification of colours in juxtaposition becomes weaker in proportion to their



PLATE II.

distance from the line of contact; and in order to observe this effect in bodies which are not contiguous, it is only necessary to experiment as described in (10).

The colours experimented upon must be as nearly as possible of equal intensity.

13. *Experimental Demonstration of Contrast of Colour.* —If we arrange as before, the two halves of an unglazed coloured sheet of paper, and two halves of another sheet of a different colour, but as nearly as possible of equal intensity, or rather of *tone* (8), upon looking at the four half-sheets *o o'*, *p p'* for a few seconds, we shall see that *o* differs from *o'* and *p* from *p'*; consequently the two half-sheets, *o p*, seem to undergo a reciprocal modification of tint, which is rendered apparent by comparing their colours with those of *o'* and *p'*.

14. No. 1. Red inclines to Violet.
Orange „ Yellow.

2. Red „ Violet.
Yellow „ Green

3. Red „ Yellow.
Blue „ Green.

4. Red „ Yellow.
Indigo „ Blue.

5. Red „ Yellow.
Violet „ Indigo.

6. Orange „ Red.
Yellow „ Bright Green.

7. Orange „ Bright Red.
Green „ Blue.

8. Orange „ Yellow.
Indigo „ Blue.

9. Orange „ Yellow.
Violet „ Indigo.

10.	Yellow	inclines to	Bright Orange.
	Green	„	Blue.
11.	Yellow	„	Orange.
	Blue	„	Indigo.
12.	Green	„	Yellow.
	Blue	„	Indigo.
13.	Green	„	Yellow.
	Indigo	„	Violet.
14.	Green	„	Yellow.
	Violet	„	Red.
15.	Blue	„	Green.
	Indigo	„	Deep Violet.
16.	Blue	„	Green.
	Violet	„	Red.
17.	Indigo	„	Blue.
	Violet	„	Red.

15. It thus appears from the experiments described in this chapter that two coloured surfaces in juxtaposition, viewed simultaneously, present to the eye two modifications—one relative to the depth of tone of their respective colours, and the other relative to the physical composition of those colours.

CHAPTER II.

The Law of the Simultaneous Contrast of Colours, and the Formula which represents it.

16. After I had assured myself that the preceding phenomena were constant for my sight when it was not fatigued, and that many persons, accustomed to judge of colours, saw them as I did, I sought to reduce them to an expression sufficiently general to render it possible to predicate the effect which would be produced upon the

organ of vision by the juxtaposition of two given colours. All the phenomena that I have observed seem to depend upon a very simple law, which in its most general sense may be enunciated in these terms: When two contiguous colours are seen at the same time, they appear as dissimilar as possible, both with regard to their optical composition and their depth of tone. Therefore there may be at once simultaneous contrast of colour, properly so called, and simultaneous contrast of tone.

17. Now two colours in juxtaposition, o and p, will differ from each other in the greatest possible degree when the complementary of o is added to p, and the complementary of p is added to o; indeed by the juxtaposition of o and p, the rays of the colour p, which o reflects when it is seen alone, and which are active in that case, cease to be so when o and p are in juxtaposition. Now under these circumstances, each of the two colours, losing what it has analogous to the other, must be so much more different from it.

18. The following formulæ will illustrate this:—

Let us represent—

The colour of the stripe O by the colour a *plus* white B,

„ „ P „ a' *plus* white B′,

the complementary colour of a by C,

„ „ a' „ c',

the colours of the two stripes seen separately are—

Colour of $O = a + B$; colour of $P = a' + B'$;

by juxtaposition they become—

$$\text{Colour of } O = a + B + c',$$
$$P = a' + B' + c.$$

We will now show that this expression amounts to taking away the rays of a' from the colour a of O (15), and to taking away the rays of the colour a from a' of P.

For let us suppose—

B reduced into two portions, white $= b +$ white $= (a' + c')$,

B′ reduced into two portions, white $= b' +$ white $= (a + c)$.

The colours of the two stripes seen separately are—

The colour of $O = a + b + a' + c'$, and the colour of $P = a' + b' + a + c$.

By juxtaposition they become—

The colour of $O = a + b + c'$, and the colour of $P = a' + b' + c$.

An expression which is evidently the same as the former, except for the values of B and B′.

19. I have said that simultaneous contrast may at the same time affect the optical composition of colours, and the depth of their tone; consequently, when colours are not of the same depth, that which is deep appears deeper, and that which is light appears lighter; that is to say, the former appears to lose white light, while the latter seems to reflect more of it. Thus *there may be, in looking at two contiguous colours, simultaneous contrast of colours and simultaneous contrast of tone.*

CHAPTER III.

The Law of Simultaneous Contrast of Colours demonstrated by the Juxtaposition of a certain Number of Coloured Bodies.

20. Let us now apply the above formula to the seventeen observations of Chapter I., and we shall see that the modifications of contiguous colours are precisely those which would result from the addition to each of them of the complementary of the contiguous colour (18). The rank these colours occupy in Chapter I. may be readily noted, as I have attached to each the number applied to it in that chapter. And for the complementary of each colour see (6). (See Plate II.)

Orange and Green, 7.

21. Orange, the complementary of Blue, being added to Green, makes it Bluer or less Yellow.
Green „ „ Red „ Orange „ Redder „ Yellow.

Orange and Indigo, 8.

22. Orange, the complementary of Blue, being added to Indigo, makes it Bluer or less Red.
Green „ „ Red „ Orange „ Redder „ Yellow.

Orange and Violet, 9.

23. Orange, the complementary of Blue, being added to Violet, makes it Blue or less Red.
Violet „ „ Orange-yellow Orange „ Yellower „ Red.

Green and Indigo, 13.

24. Green, the complementary of Red, being added to Indigo, makes it Redder or more Violet.
Indigo „ „ Orange-yellow Green „ Yellow.

Green and Violet, 14.

25. Green, the complementary of Red, being added to Violet, makes it Redder.
Violet „ „ Green-yellow Green „ Yellower.

Orange and Red, 1.

26. Orange, the complementary of Blue, being added to Red, makes it Violet or Crimson.
Red „ „ Green „ Orange „ Yellower.

Violet and Red, 5.

27. Violet, the complementary of Green-yellow, being added to Red, makes it Orange-yellow.
Red „ „ Green „ Violet „ Indigo.

Indigo and Red, 4.

28. Indigo, the complementary of Orange-yellow being added to Red, makes it Orange.
Red „ „ Green „ Indigo „ Blue.

Orange and Yellow, 6.

29. Orange, the complementary of Blue, being added to Yellow, makes it Greener.
Yellow „ „ Indigo „ Orange „ Redder.

Green and Yellow, 10.

30. Green, the complementary of Red, being added to Yellow, makes it Orange.
Yellow „ „ Indigo-violet „ Green „ Blue.

Green and Blue, 12.

31. Green, the complementary of Red, being added to Blue, makes it Indigo.
Blue „ „ Orange „ Green „ Yellower.

Violet and Blue, 16.

32. Violet, the complementary of Greenish-yellow, being added to Blue, makes it Greenish.
Blue „ „ Orange „ Violet „ Redder.

Indigo and Blue, 15.

33. Indigo, the complementary of Orange-yellow, being added to Blue, makes it Green.
Blue „ „ Orange „ Indigo „ Violet.

Red and Yellow, 2.

34. Red, the complementary of Green, being added to Yellow, makes it Green.
Yellow „ „ Indigo-violet „ Red „ Violet.

Red and Blue, 3.

35. Red, the complementary of Green, being added to Blue, makes it Green.
Blue „ „ Orange „ Red „ Orange.

Yellow and Blue, 11.

36. Orange-yellow, the complementary of Indigo-violet, being added to Blue, makes it Indigo.
Blue „ „ Orange „ Yellow „ Orange.

Indigo and Violet, 17.

37. Indigo, the complementary of Orange-yellow, being added to Violet, makes it Red.
Violet „ Greenish-yellow „ Indigo „ Bluer.

38. It is evident that, all other things being equal, the modifications of contiguous colours will be so much the more marked, as the complementary colour C or C′, which is added to each of them, differs more from them; for the complementary C′ which is added to the colour O, is identical with it, as the complementary C is identical with the colour P to which it is added; and the modifications of O and P will simply augment the intensity of their colours. But are there yet any two bodies known which present to the observer two pure colours perfectly complementary to each other? Certainly not; all those which are coloured by reflection reflect (7), besides white light, a great number of rays of various colours. We cannot instance a *red* body and a *green* body, or an *orange* and a *blue*, or an *orange-yellow* and an *indigo*, or a greenish-yellow and a *violet*, which reflect pure or mixed colours, absolutely complementary to each other. So that the juxtaposition of these colours produces only a simple *augmentation of their intensity*. Hence, although it is less easy to verify the law of contrast with respect to red and green, or orange and blue, &c., than with respect to those which are the object of the seventeen experiments just described (15), yet, upon applying it to the former, it will be seen that their colours acquire a most remarkable brilliancy, strength, and purity. This result, perfectly conformable to the law, may be easily understood: for example, an orange-coloured object reflects blue rays, as a blue object reflects orange rays (7). Hence, when a blue stripe is put in contact with an orange stripe, although it is admitted that the first appears to the eye to receive blue from the orange of the second, as this appears to receive orange from the blue of the blue stripe; or what is the same thing, that the blue stripe appears to destroy the effect of the blue rays

of the second stripe, as these appear to destroy the effect of the orange rays of the blue stripe—it is evident that the two colours so contrasted must purify each other, and become more intense. But the blue may incline to green or violet, and the orange to yellow or red; that is to say, the modification may not only affect the intensity of the colour, but also its physical composition. However, if this latter effect take place, it is always much more feeble than the first. Besides, if you look several times at the same coloured stripes, you will see that the blue which at first had appeared to you greenish will afterwards appear inclining to violet; and that the orange, which had appeared at first yellowish, will incline to red; so that the phenomena of modification, as it affects the physical composition of colour, will not have the constancy of those which are the subject of the preceding seventeen observations (15). I now proceed to state the observations I have made on colours which are most nearly complementary to each other.

Red and Green.

39. *Red,* the complementary of Green, placed by the side of Green, increases its intensity.*
Green, the complementary of Red, placed by the side of Red, increases its intensity.

Such is the theoretical result, the experimental result entirely agrees with it. When we place a green, inclining

* In the original French Edition there is evidently a confusion of terms in this and the two following articles (39, 40, 41, 42). The Red is there represented as placed in juxtaposition with *red*, and green with *green*, and so on with the other instances; orange and blue; orange-yellow and indigo; greenish-yellow and violet; instead of being made by contrast with their respective complementaries to intensify each other.

more to yellow than to blue, side by side with, 1st, a slightly orange-red, 2nd, a slightly crimson-red, and 3rd, an intermediate red, and repeat our observations several times on each of these assemblages of colour, we shall observe different results; that is to say, in one case the red will appear more orange and the green yellower, and in another the red will appear more violet and the green bluer. We shall find also that the change may be attributed as much to a difference in the intensity of the light upon the colours as to fatigue of the eye.

When we place a green, inclining rather to blue than to yellow, side by side with, 1st, a slightly orange-red, 2nd, a slightly crimson-red, and 3rd, an intermediate red, the results are the same as with the first green, but with this difference,—that in the assemblage of bluish-green and of slightly crimson-red, observed several times, the green and the red appear almost constantly yellower than they are separately. A result very easily understood.

Orange and Blue.

40. *Blue, the complementary of Orange, placed by the side of Orange, increases its intensity.*
Orange, the complementary of Blue, placed by the side of Blue, increases its intensity.

Upon repeating these observations with a deep blue and an orange which is not too red, the two colours appear commonly to become redder.

Orange-Yellow and Indigo.

41. *Orange-yellow, the complementary of Indigo, placed by the side of Indigo, increases its intensity.*
Indigo, the complementary of Orange-yellow, placed by the side of Orange-yellow, increases its intensity.

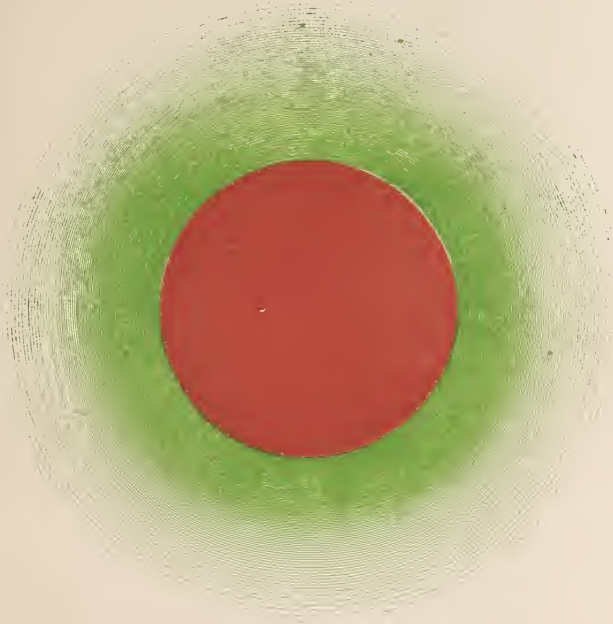


PLATE III.

Greenish-Yellow and Violet.

42. *Greenish-yellow, the complementary of Violet, placed by the side of Violet, increases its intensity.*
Violet, the complementary of Greenish-yellow, placed by the side of Greenish-yellow, increases its intensity.

The result of observation is almost always in conformity with this law.

43. According to the law of the simultaneous contrast of colours, and the insensible gradation of modification, beginning at the contiguous edges of the colours in juxtaposition (11), we may show, by means of coloured circular spaces, the modifications which the principal colours induce in those which are contiguous to them.

Place wafers, circular pieces of paper, or any other convenient material about an inch and a half in diameter, coloured red, green, orange, blue, greenish-yellow, violet, indigo, and orange-yellow, each separately upon a sheet of white paper ; then tint the white paper around the circle with its complementary colour, gradually softening it off from the coloured circle, when it will be found that

The Red circle tends to colour the surrounding space

with	its	complementary	Green.
Green	„	„	Red.
Orange	„	„	Blue.
Blue	„	„	Orange.
Greenish-yellow		„	Violet.
Violet	„	„	Greenish-yellow.
Indigo	„	„	Orange-yellow.
Orange-yellow		„	Indigo.

These figures are designed to exhibit the effects of contrast to those persons who, not having studied physical laws, are, notwithstanding, desirous of understanding these effects.

CHAPTER IV.

On the Juxtaposition of Coloured Surfaces with White.

44. When white bodies are viewed simultaneously with coloured bodies contiguous to them, they are sensibly modified. I confess that the modification is too feeble to be determined with absolute certainty while we are ignorant of the law of contrast; but, understanding that, and knowing the modifications that white undergoes in connexion with certain colours, we shall not fail to recognise this modification in special cases, provided the colours opposed to the white be not too deep.

Red and White.

45. Green, complementary to Red, being added to White, the Red appears more brilliant and deeper.

Orange and White.

46. Blue, complementary to Orange, being added to White, the Orange appears more brilliant and deeper.

Greenish-Yellow and White.

47. Violet, complementary to Greenish-yellow, being added to White, the Yellow appears more brilliant and deeper.

Green and White.

48. Red, complementary to Green, being added to White, the Green appears more brilliant and deeper.

Blue and White.

49. Orange, complementary to Blue, being added to White, the Blue appears more brilliant and deeper.

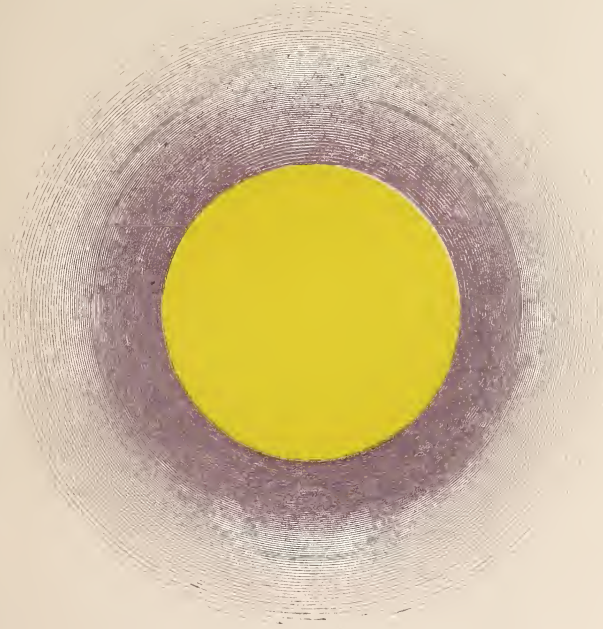


PLATE IV.

Indigo and White.

50. Yellowish-orange, complementary to Indigo, being added to White, the Indigo appears more brilliant and deeper.

Violet and White.

51. Yellowish-green, complementary to Violet, being added to White, the Violet appears more brilliant and deeper.

Black and White.

52. Black and white, which may be considered in some respects complementary to each other, become, conformably to the law of contrast of tone, more different than when seen separately. This results from the effect of the white light, which is reflected by the black (4), being more or less destroyed by the light of the white stripe. By an analogous action, the white heightens the tone of the colours to which it is contiguous.

CHAPTER V.

On the Juxtaposition of Coloured Bodies with Black.

(See Plate 9, Page 54.)

53. A BLACK surface being deeper than that which is contiguous to it, the contrast of tone tends to deepen it still more, while it tends to lower the tone of the contiguous colour; as on the other hand white, placed in juxtaposition with it, would heighten it. So much for contrast of tone.

54. Black surfaces reflect a small quantity of white light (4), and this falling upon the retina simultaneously with the coloured light of a contiguous body, it is evident that the black surface must appear tinted with the

complementary of the coloured light; but it will be a weak tint, since it is displayed upon a ground which has but a feeble power of reflecting light. So much for the contrast of colour.

55. The lowering of the tone of the colour contiguous to the black is constantly observed; but a very remarkable fact is the weakening of the black itself, when the contiguous colour is deep, and of a nature to give a luminous complementary, as orange, orange-yellow, greenish-yellow, &c.

Red and Black.

56. Green (the complementary of Red), when placed by the side of Black, makes it appear Reddish. The Red looks clearer, partaking less of Orange.

Orange and Black.

57. A Blue (the complementary of Orange), when placed by the side of Black, causes it to appear less brilliant, or somewhat rusty, while Orange by the side of Black appears more brilliant in colour.

Greenish-Yellow and Black.

58. Greenish-yellow (the complementary of Violet), when placed by the side of Black, gives it a Violet tint, whilst the Greenish-yellow becomes clearer and more Green; but there are some kinds of Yellow which are weakened by the side of Black.

Green and Black.

59. Red (the complementary of Green), when placed by the side of Black, causes the Black to appear more Violet or Reddish; whilst Green by the side of Black becomes slightly Yellower.



PLATE V.

Blue and Black.

60. Orange (the complementary of Blue), when placed by the side of Black, causes it to appear brighter, while the Blue becomes clearer and somewhat Greener.

Indigo and Black.

61. Orange-yellow (the complementary of Indigo), placed by the side of Black, causes it to look much brighter. The Indigo also appears brighter.

Violet and Black.

62. Violet (the complementary of Greenish-yellow), when placed by the side of Black, lightens it up; whilst the Violet becomes more brilliant and clear, and somewhat Reddish.

CHAPTER VI.

On the Juxtaposition of Coloured Bodies with Grey.

(See Plate 10, Page 58.)

63. As the brilliancy of the light reflected by white bodies is one of the principal causes which render the sight insensible to the modifications produced in white by the juxtaposition of coloured bodies; and, on the other hand, as the feeble light reflected from black bodies is unfavourable to our perception of the modifications which they sustain from the proximity of coloured bodies, especially when the complementary of the colour of these bodies is but slightly luminous, it may be conceived that grey bodies, judiciously selected with regard to their depth of tone, would, by contiguity to coloured bodies, exhibit the phenomena of contrast of colour in a more striking manner than either black or white bodies would.

Red and Grey.

64. Grey appears Greenish by receiving the influence of its complementary Red.

The Red appears purer, less Orange perhaps.

Orange and Grey.

65. Grey appears Bluer by receiving the influence of its complementary Orange.

The Orange appears purer, more brilliant, Yellower perhaps.

Yellow and Grey.

66. Grey appears to incline to Violet by receiving the influence of its complementary Yellow.

The Yellow appears more brilliant, and yet less Green.

Green and Grey.

67. Grey appears to incline to Red by receiving the influence of its complementary Green.

The Green appears more brilliant, Yellower perhaps.

Blue and Grey.

68. Grey appears to incline to Orange by receiving the influence of its complementary Blue.

The Blue appears more brilliant, Greener perhaps.

Indigo and Grey.

69. Grey appears to incline to Orange by receiving the influence of its complementary Blue.

The Blue appears more brilliant, Greener perhaps.

Violet and Grey.

70. Grey appears Yellowish by receiving the influence of its complementary Violet.

Violet appears fresher, less dull.

70*a*. The grey, which was the subject of the above experiments, was as free as possible from every colouring matter foreign to black; it belonged to the scale of normal black (see Part II., 164)—that is to say, it resulted from a mixture of the purest possible black and white materials. By juxtaposition with white, it appeared deeper, and the white appeared more pure; while by juxtaposition with black, it appeared lighter and more rusty, and the black appeared deeper.

70*b*. One result of the complementaries of colours in juxtaposition with grey being more perceptible than when these colours are juxtaposed with white or black, is, that if instead of a *normal grey*, we juxtapose a *grey, tinted* either with *red, orange, yellow*, &c., these tints will be greatly heightened by the complementaries added to them. For example, a bluish grey will receive a very perceptible increase of blue from its proximity to orange, and a yellowish-grey will take a perceptible green tint from the same proximity.

NOTE.—*The chemical nature of coloured substances has no influence upon the phenomena of simultaneous contrast.*

71. The chemical nature of coloured bodies in juxtaposition has no influence upon the modifications of their colours. Whatever may happen to be the chemical composition of the coloured bodies, provided they be identical to the sight, they yield the same results. I need only cite the following examples :—Indigo, Prussian blue, cobalt, ultramarine, as nearly alike as possible, gave the same sort of modification; orange prepared from red lead, annotto, or a mixture of woad and madder, caused the same modification of the colours to which they were adjacent.

CHAPTER VII.

On the Juxtaposition of Coloured Bodies belonging to the Colours of the same Group of Coloured Rays.

72. Whenever there is a great difference between two contiguous colours, the difference becomes still more appreciable by putting the same colour successively in juxtaposition with the various colours belonging to the same group. For example, *orange and red.*

Orange being placed beside scarlet-red, pure red and crimson-red, it will be seen that the red acquires a purple and the orange a yellow tint.

Violet being placed beside scarlet-red, pure red and crimson-red, gives analogous results: the violet always appears bluer, and the red yellower or less purple.

73. These observations explain why we obtain results in accordance with the formula, even when such coloured substances are used as are far from exhibiting pure colours, namely, stained papers or stuffs.

74. The juxtaposition of coloured stripes is a means of demonstrating the difficulty of determining the types of pure colours by common pigments; at least, if we do not take into consideration the law of simultaneous contrast. For instance—

1. Place red in contact with orange-red; the first will appear purple and the second yellower, as above; but if the first red be placed beside purplish-red, the latter will appear bluish, and the former more yellow or orange; so that the same red will be purple in one case and orange in the other

2. Place yellow beside orange-yellow, the former

will appear greenish and the latter redder ; but if you put the first yellow beside a greenish-yellow, the last will appear greener, and the yellow more orange ; so that the same yellow will incline to green in one case, and to orange in the other.

3. Place blue beside greenish-blue, the former will incline to violet, and the second will appear yellower. Put the same blue beside a violet-blue, the former will incline to green, and the second will appear redder ; so that the same blue will be violet in one case and greenish in the other.

75. Hence we see that the colours which painters term simple—red, yellow, and blue—pass insensibly by juxtaposition into the condition of compound colours, since the same red is purple or orange ; the same yellow is orange or green ; and the same blue is green or violet.

CHAPTER VIII.

On the Application of the Law of Contrast to the Hypothesis that Red, Yellow, and Blue are the only Primary Colours ; and that Orange, Green, Indigo, and Violet are Secondary or Composite Colours.

76. The experiments to which I have just applied the principle of the modification which colours undergo by juxtaposition, and the explanation consequent upon the manner in which white light has been considered, are also clearly explained in the language of painters and dyers, who admit of only three primary colours—red, yellow, and blue. As there are persons who, while they hold this opinion, desire, notwithstanding, to give a reason for the phenomena resulting from the juxtaposition

of colours, I will explain them in accordance with this language; and, for greater clearness, I make five groups of juxtaposed colours, beginning with those which include the observations to which the preceding law is most easily applied. I shall presume that orange is composed of red and yellow, green of yellow and blue, indigo and violet of red and blue.

FIRST GROUP.—*Two Secondary Colours having a Simple Colour as a Common Element.*

It is very easy to verify the law when we look at two colours which form part of the group: we see that by their reciprocal influence they lose more or less of the colour which is common to them. It is evident that they become more unlike each other in proportion to this loss.

1. *Orange and Green.*—These colours having the element yellow in common, lose it by juxtaposition. *The orange appears redder, and the green bluer.*

2. *Orange and Indigo.*—These colours having the element red in common, lose it by juxtaposition. *The orange appears yellower, and the indigo greener.*

3. *Orange and Violet.*—Like the preceding.

4. *Green and Indigo.*—These colours having the element blue in common, lose it by juxtaposition. *The orange appears yellower, and the indigo bluer.*

5. *Green and Violet.*—Like the preceding.

SECOND GROUP.—*A Compound Colour, and a Simple Colour, which is found in the Compound.*

Plate 6.

1. *Orange and Red.*—The orange loses red, and appears yellower; the red becomes bluer, to differ as much as possible from the orange.

2. *Violet and Red.*—The violet loses red, and ap-

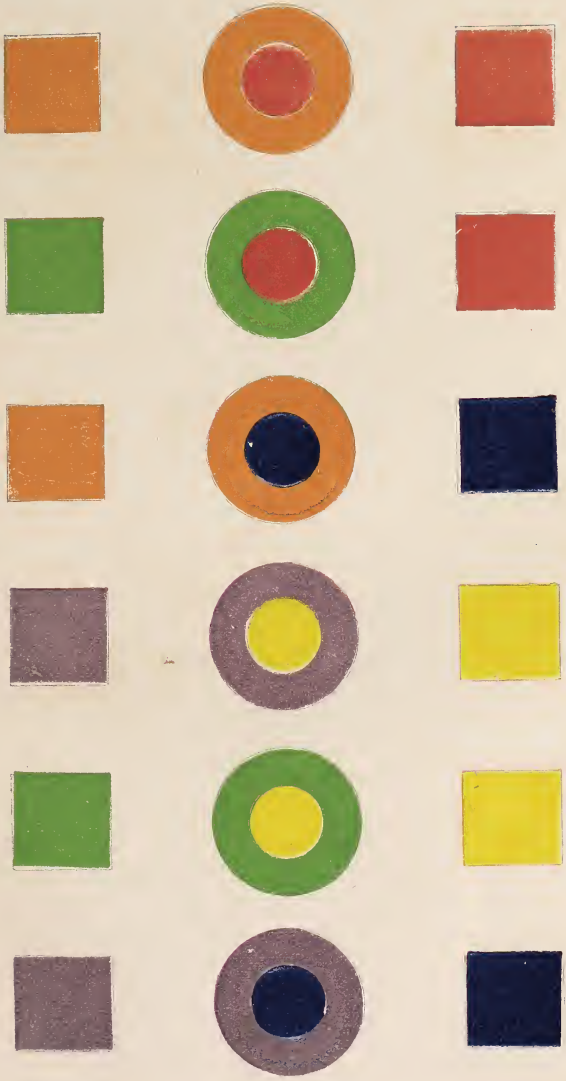


PLATE VI.

pears bluer; the red becomes yellower, to differ as much as possible from the violet.

3. *Indigo and Red.*—Like the preceding.

4. *Orange and Yellow.*—The orange loses yellow, and appears redder; the yellow becomes bluer, to differ as much as possible from the orange.

5. *Green and Yellow.*—The green loses yellow, and appears bluer; the yellow becomes redder, to differ more from the green.

6. *Green and Blue.*—The green loses blue, and appears yellower; the blue becomes redder, to differ as much as possible from the green.

7 *Violet and Blue.*—The violet loses blue, and appears redder; the blue must become yellower to differ as much as possible from the violet.

8. *Indigo and Blue.*—Like the two preceding.

THIRD GROUP. *Two Simple Colours.* (See 6, 7.)

1. *Red and Yellow.*—Red in losing yellow appears bluer; and the yellow losing red appears bluer; or, in other words, the red inclines to purple, and the yellow to green.

2. *Red and Blue.*—The red in losing blue appears yellower; and the blue losing red appears yellower; or, in other words, the red inclines to orange, and the blue to green.

3. *Yellow and Blue.*—The yellow in losing blue appears redder; and the blue losing yellow appears more violet; or, in other words, the yellow inclines to orange, and the blue to violet.

FOURTH GROUP.—*Two Compound Colours consisting of the same Simple Colours.*

Indigo and Violet.—As indigo differs from violet only

in containing more blue in proportion to red, it follows that the difference will be greatest when the indigo loses red and inclines to greenish blue, while the violet, by gaining red, inclines toward that colour. It is clear that, if the violet lost red, or if the indigo acquired it, the two colours would approximate; but, as they differ from each other, the first effect ensues.

We may further explain the preceding phenomena by considering indigo relatively to violet, as blue; then it will lose its blue, which is common to both colours, and incline to green; while the violet, also losing its blue, will appear redder.

FIFTH GROUP.—*A Compound Colour, and a Simple Colour, which is not found in the Compound.*

1. *Orange and Blue.* 2. *Green and Orange.* 3. *Violet and Greenish Yellow.*

Upon the hypothesis that orange, green, and violet are compound colours, and that red, blue, and yellow are simple, it follows that in opposing them in the order in which they are reciprocally complementary, and supposing also that the colours so juxtaposed are entirely free from any foreign colour, there appears no reason for the compound colour losing one of its elements rather than another, or for the simple colour being unlike one of the elementary colours rather than another. For instance, in the juxtaposition of green and red, we see no reason why green should pass into blue rather than into yellow, or why the red should incline to blue rather than to yellow.

SECTION II.

ON THE DISTINCTION BETWEEN SIMULTANEOUS, SUCCESSIVE, AND MIXED CONTRAST OF COLOURS, AND ON THE CONNEXION BETWEEN THE EXPERIMENTS MADE BY THE AUTHOR, AND THOSE PREVIOUSLY MADE BY OTHER OBSERVERS. DISTINCTION BETWEEN SIMULTANEOUS, SUCCESSIVE, AND MIXED CONTRAST OF COLOURS.

77. BEFORE speaking of the relation of my experiments to those made by others on the contrast of colours, we must distinguish three classes of contrast. The *first* includes those relating to the contrast which I term *simultaneous;* the *second* to that which I term *successive;* and the *third* to that which I term *mixed.*

78. *Simultaneous contrast of colours* includes that phenomena of modification which objects variously coloured seem to undergo in physical composition, and in the depth of tone of their respective colours, when seen at the same time.

79. *Successive contrast of colours* includes the phenomena observed when the eyes having looked for some time at one or more coloured objects, perceive, after having ceased to look at them, images of those objects, presenting the colour complementary to that of the actual object.

80. This distinction also facilitates the understanding of the phenomena which may be called *mixed contrast;* for, the retina having seen a certain colour for some time, has an aptitude to see for a further time the complementary of that colour, as well as any new colour presented by an external object; the sensation perceived being the result of this new colour, and the complementary of the first.

For want of this distinction, one of the branches of optics most fertile in applications, has not been treated with the clearness and precision which are necessary to show its importance to those who have not experimented upon it.

81. The following is a simple mode of observing *mixed contrast*:—Having closed one eye, the right for example, look steadily with the left at a sheet of paper of a colour A; when this colour seems to become dull, look immediately at a sheet of paper of the colour B, the eye then has the impression produced by the mixture of this colour B with the complementary (C) of the colour A.

82. To be convinced of this mixed sensation, it is only necessary to shut the left eye, and to look at the colour B with the right eye; when the sensation perceived is not only that of the colour B, but it may appear modified in the contrary way to that of the mixed sensation C + B, or what is the same, it appears to be rather A + B.

83. Upon shutting the right eye, and looking again at the colour B with the left eye, and that many times in succession, different sensations are successively perceived, but more and more feebly, until at length the left eye returns to its normal state.

84. I advise any person who thinks that one of his eyes is more able to perceive colours than the other, to look at a sheet of paper alternately with the right and left eye; if the sensations of each are identical, he may conclude that he has deceived himself. And even if the sensations be different, the experiment should be repeated several times, successively, for the difference observed in a single experiment might be occasioned by one of the eyes having been previously modified or fatigued.

85. This practice appears to me especially useful to painters. I now give some examples of mixed contrast.

86. The left eye, having looked for some time at red, has an aptitude to see afterwards green, the complementary of red. If then it be attracted by yellow, it perceives a sensation resulting from the mixture of green and yellow. The left eye being shut, and the

right eye, which has not been modified by the sight of red, being opened, it sees yellow, and it is possible that this yellow may appear more orange than it is really.

	If the left eye had first seen	*and had afterwards seen*	*the latter would have seemed*
	Yellow	Red	Violet.
88.	Red	Blue	Greenish.
89.	Blue	Red	Orange-red.
90.	Yellow	Blue	Blue-violet.
91.	Blue	Yellow	Orange-yellow.
92.	Red	Orange	Yellow.
93.	Orange	Red	Red-violet.
94.	Red	Violet	Deep blue.
95.	Violet	Red	Orange-red.
96.	Yellow	Orange	Red.
97.	Orange	Yellow	Greenish-yellow.
98.	Yellow	Green	Bluish-green.
99.	Green	Yellow	Orange-yellow.
100.	Blue	Green	Yellow-green.
101.	Green	Blue	Blue-violet.
102.	Blue	Violet	Reddish-violet.
103.	Violet	Blue	Greenish-blue.
104.	Orange	Green	Bluish-green.
105.	Green	Orange	Reddish-orange.
106.	Orange	Violet	Bluish-violet.
107.	Violet	Orange	Yellowish-orange.
108.	Green	Violet	Red-violet.
109.	Violet	Green	Yellow-green.
110.	Red	Green	Bluer.
111.	Green	Red	Tinted-violet.
112.	Yellow	Violet	A little bluer.
113.	Violet	Yellow	Greenish.
114.	Blue	Orange	Yellower.
115.	Orange	Blue	More violet.

116. I should observe that all these colours, at least to my eyes, did not undergo equally intense or equally continuous modifications. For instance, the modification produced by the successive view of yellow and violet, or of violet and yellow, is stronger and more durable than that produced by the successive view of blue and orange, and still more than that of orange and blue. The modification produced by the successive view of red and green, of green and red, is but slight, and not enduring.

I may also add that the depth of tone exercises some influence on the modification; for, if after looking at orange, we look at dark blue, the latter will appear greenish rather than violet, a result contrary to that afforded by a light blue.

117. I have thought it the more necessary to mention under a special name the phenomenon which I call *mixed contrast*, as it explains certain facts remarked by dealers in coloured fabrics, as well as the inconvenience felt by painters, who, wishing to produce an exact imitation of their models, look at them so long as to be unable to perceive their tones and modifications. I will mention two facts which have been communicated to me by manufacturers, referring the reader to Part II. for the application of the study of mixed contrast to painting.

118. First Fact. When a purchaser has looked a long time at a yellow cloth, and he is then shown an orange, orange-red, or scarlet one, he finds it dull, and judges it to be a dark or crimson-red; because the retina affected by the yellow has a tendency to see violet; and hence all the yellow of the orange colour disappears, and the eye sees it as a red, or a red inclining to violet.

119. Second Fact. If there be presented to a pur-

chaser, one after another, fourteen pieces of a red fabric, he judges the six or seven last pieces to be less beautiful than the first, although they may be all identical. What is the reason of this false judgment? It is, that the eyes which have seen six or eight red pieces in succession, are in the same condition as if they had looked steadily for the same length of time at a single red stuff, —having a tendency to see the complementary of red, that is green. This tendency necessarily enfeebles the brilliancy of the red of the last pieces. The dealer, therefore, that he may not be a sufferer from the fatigued eyes of his customer, after showing him a few red pieces, should present some green ones, to restore the eyes to their normal state. If the view of the green were sufficiently prolonged to pass the normal state, the eyes would acquire a tendency to see red, and then the pieces seen last would appear more beautiful than the rest.

PART THE SECOND.

ON THE APPLICATION OF THE LAW OF SIMULTANEOUS CONTRAST OF COLOURS.

INTRODUCTION.

120. BEFORE entering into the details of these applications, I think it necessary to offer some considerations which will enable me to establish some propositions or principles, to which I shall have frequent occasion to refer. I propose to give—

121. 1. Definitions of several expressions applicable to colours and their modifications. 2. The means of representing and defining colours and their modifications by the aid of diagrams. 3. A classification of the harmonies of colours. 4. A view of some arrangements of the primary colours with white, black, and grey.

SECTION I.

Definition of the words Tones, Scales, and Hues.

122. THE words *Tones* and *Hues* recur continually, both in common language and in that of artists; yet they are not so well defined as to be free from ambiguity, or to be well understood.

123. The word TONE of a colour will be employed exclusively to designate the various modifications which that colour, in its greatest intensity, is capable of receiving from white, which *lowers* its tone, or of black, which *heightens* it.

124. The word SCALE will be applied to the assem-

blage of tones of the same colour, thus modified. The pure colour is the normal tone of the scale, if the normal tone does not belong to a broken or reduced scale—*i.e.*, to a scale, of which all the tones are made dull with black (149).

125. The word HUE will be applied exclusively to the modifications which a colour receives from the addition of a small quantity of another. We shall speak, for example, of the *tones* of the blue scale, the *tones* of the red scale, &c. We say the *hues* of blue to designate all the scales whose colours, still remaining blue, yet differ from pure blue; each hue comprehending the tones which constitute a scale more or less allied to the blue scale.

126. I have defined the tones of a colour to be the various modifications, which that colour at its maximum of intensity is capable of receiving from black and white; it must be observed that the condition "maximum of intensity for receiving black," is absolutely essential to this definition; for if black be added to a tone below the maximum, it would pass into another scale. Artists distinguish colours as *pure, broken, reduced, grey,* or *dull.*

127. Pure colours are those termed *simple,* red, yellow, blue, and those which result from their binary compounds, orange, green, violet, and their *hues.* (150.) *Broken* colours are the pure colours mixed with black, from the tone of the lightest to the deepest. According to these definitions, it is evident that in all the scales of simple and binary colours, the tones which are above the pure colour are *broken* tones.

128. Artists, and especially painters and dyers, admit that the mixture of three primary colours, in a certain

proportion, gives black; hence, when these three colours are so mixed that two predominate, black will result, formed from the union of the whole of the colour, which is in small quantity, within suitable proportions of the two predominant colours. For example, if blue be mixed with red and yellow, a little black is produced, which reduces or *breaks* the orange.

129. We must remember that the *primary colours* of painters are not those of the prismatic spectrum, but substances employed by them, as red, yellow, and blue colours.

SECTION II.

Of Diagrams designed to Represent and Define Colours and their Modifications.

130. Various contrivances have been proposed under the titles of Tables, Scales, Colour-Circles, Chromatometers, &c., for representing either by numbers or a rational nomenclature, colours and their modifications. They are generally founded on these three propositions:—1. There are three primary colours. 2. Equal portions of these colours being mixed, produce pure secondary colours. 3. Equal portions of the three primary colours produce black.

131. But we know of no substance which exhibits pure colour; that is, which reflects only one kind of coloured rays, whether pure red, pure yellow, or pure blue. And since it is impossible to procure pure colouring matters, how can it be said that orange, green, and violet are composed of two simple colours mixed in equal proportions? Or that black consists of a mixture of equal parts of three simple colours?

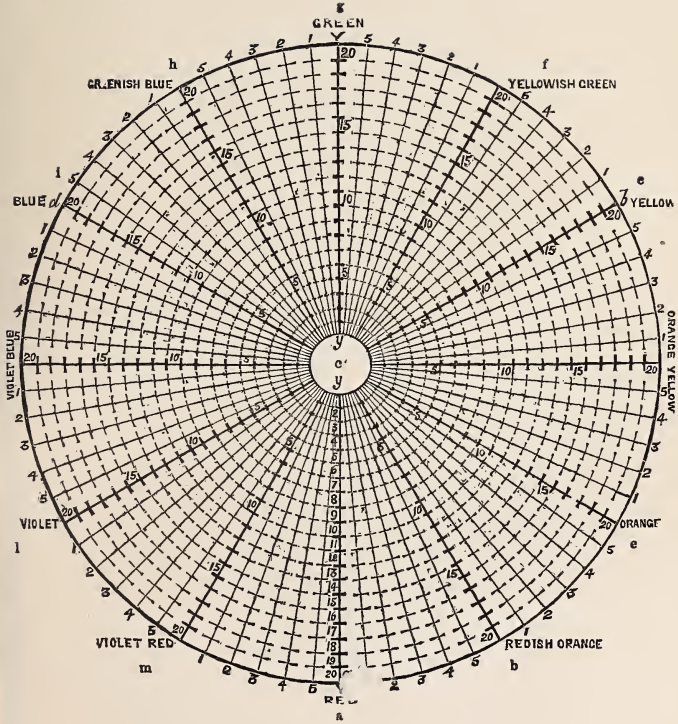

g
GREEN
h
GREENISH BLUE
f
YELLOWISH GREEN
i
BLUE
e
YELLOW
k
VIOLET BLUE
d
ORANGE YELLOW
VIOLET
ORANGE
l
e
VIOLET RED
REDISH ORANGE
m
b
RED
a
Y
c'
y

PLATE VII.

These chromatic tables, &c., point out mixtures which do not produce the results deducible from the principles on which they are said to be based.

132. But most of the blue, red, and yellow colours with which we are acquainted, give, by their binary compounds, violet, green, and orange inferior in brilliancy to the natural violet, green and orange colours of objects. This result would be explained by admitting that colours mixed two by two, reflect at least two kinds of coloured rays; and that where there is any mixture of colours which reflect separately red, yellow, and blue, there is produced a certain amount of black which reduces the brilliancy of the mixture.

133. Conformably with this view, the violet, green, and orange colours which result from a mixture of coloured matters, are most brilliant when the respective colours of these materials approach each other. For example, a mixture of blue and red inclines more to violet than a mixture of blue and yellow inclines to green, and that of red and yellow inclines still more to orange.

134. In order to represent all the modifications that I have called *tones* and *hues* of colours, as well as the relations which exist between those that are complementary to each other, I have devised the following diagram (Plate 7). From a centre, *c*, I describe two circumferences, *y* Y. I divide each of these by means of three rays, *c a*, *c b*, *c d*, into arcs of 120 degrees each. I divide the portion of each ray comprised between the two circles *y* Y into twenty parts, which represent as many tones of the colours red, yellow, and blue.

135. In each of the scales of these three colours there

is one tone, which, when pure, represents the colour of the scale to which it relates. I therefore call it the *normal tone of that scale.* If we represent a unit of surface *s*, entirely covered by the pigment which reflects the normal colour, and if we suppose that this colouring matter is equally distributed over the surface *a* 1, we shall represent the tones superior to the normal tone by the unit of surface covered with 1 of the normal colour, plus the quantities of black increasing with the number of tones; and we shall represent the inferior tones by the unit of surface covered with a fraction of the quantity 1, constituting the normal tone, mixed with (—) quantities of black, as the tone has a less elevated number. If the tone 15 of the red scale be the normal tone, the normal tone of the yellow scale will have a lower number, while the normal tone of the blue scale will have a higher number. This depends upon the unequal lightness of the colours.

136. If each arc of 120° be divided into two of 60° and if radii pass through the points of division, beginning at *y*, there will be represented twenty tones of the orange, green, and violet scales, the colours at the extremities of each diameter being complementary to one another. Each arc of 60° might be divided into arcs of 30°, and thus would be obtained radii representing twenty tones of scales, which I shall call orange-red, orange-yellow, greenish-yellow, greenish-blue, bluish-violet, and violet-red.

137. By dividing each arc into five, for example, by means of five radii, which I divide into twenty parts each, beginning at the circumference *y*, I shall obtain sixty new scales.

138. Beginning with red, I designate them as follows :—

	a Red	*e* Yellow	*i* Blue
	1 Red	1 Yellow	1 Blue
	2 Red	2 Yellow	2 Blue
	3 Red	3 Yellow	3 Blue
	4 Red	4 Yellow	4 Blue
	5 Red	5 Yellow	5 Blue
139.	*b* Red-orange	*f* Yellow-green	*k* Blue-violet
	1 Red-orange	1 Yellow-green	1 Blue-violet
	2 Red-orange	2 Yellow-green	2 Blue-violet
	3 Red-orange	3 Yellow-green	3 Blue-violet
	4 Red-orange	4 Yellow-green	4 Blue-violet
	5 Red-orange	5 Yellow-green	5 Blue-violet
140.	*c* Orange	*g* Green	*l* Violet
	1 Orange	1 Green	1 Violet
	2 Orange	2 Green	2 Violet
	3 Orange	3 Green	3 Violet
	4 Orange	4 Green	4 Violet
	5 Orange	5 Green	5 Violet
141.	*d* Orange-yellow	*h* Green-blue	*m* Violet-red
	1 Orange-yellow	1 Green-blue	1 Violet-red
	2 Orange-yellow	2 Green-blue	2 Violet-red
	3 Orange-yellow	3 Green-blue	3 Violet-red
	4 Orange-yellow	4 Green-blue	4 Violet-red
	5 Orange-yellow	5 Green-blue	5 Violet-red

I attach no importance to this nomenclature ; I employ it only as the simplest to distinguish the seventy-two scales just described. The number may be increased indefinitely, by inserting as many as we choose between the above.

142. Let us now represent the gradations of each colour in the scales of the circle by the addition to it of black, progressively increasing till it becomes pure black.

Imagine a quadrant whose radius is equal to that of the circle, and arranged so as to turn upon an axis perpendicular to the plane of the circle. Divide this quadrant, 1st, by concentric arcs $y\ y'$, which coincide with the circles denoted by the same letters; 2nd, by ten radii, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. Divide each of these radii into twenty parts, representing twenty tones, corresponding to the tones of the scales represented on the circle.

143. I suppose that the tenth radius comprises the gradations of normal black, covering the half-circle described by the movement of the quadrant upon its axis; this black mixed in decreasing quantities, with increasing quantities of white, gives the twenty tones of normal grey, and ends by being lost in the white situated above the tone 1. I suppose, further, that the normal tone of each of the scales taken upon each of the radii of the quadrant 1, 2, 3, 4, 5, 6, 7, 8, 9, is formed of the mixture of black with the colour of any of the scales that the circle contains, and in such a proportion that the normal tone 15 of that scale is represented by the unit of surface covered with 1, or $\frac{10}{10}$ of red.

144. The tone 15 of the scale of the

1st	Radius	=	$\frac{9}{10}$	of Red	+	$\frac{1}{10}$	of Black.
2nd	,,	=	$\frac{8}{10}$	,,	+	$\frac{2}{10}$	,,
3rd	,,	=	$\frac{7}{10}$	,,	+	$\frac{3}{10}$	,,
4th	,,	=	$\frac{6}{10}$	,,	+	$\frac{4}{10}$	,,
5th	,,	=	$\frac{5}{10}$	,,	+	$\frac{5}{10}$	,,
6th	,,	=	$\frac{4}{10}$	,,	+	$\frac{6}{10}$	,,
7th	,,	=	$\frac{3}{10}$	,,	+	$\frac{7}{10}$	,,
8th	,,	=	$\frac{2}{10}$	,,	+	$\frac{8}{10}$	,,
9th	,,	=	$\frac{1}{10}$	,,	+	$\frac{9}{10}$	,,

These proportions relate to the effect of the mixtures upon the eye, and not to the material quantity of the red and black substances.

145. We see then—1. That each of these *tones*, 15, composed of colour and black, reduced by white and deepened by black, gives a scale of twenty tones, so much the more broken as they are nearer the scale of normal black. 2. That the quadrant by its movement upon the axis of the circle, represents the scales of every colour except red, broken by black. These broken scales are equidistant, and are formed of equidistant tones. 3. That all the colours are thus contained in a circle, whose plan comprehends the pure colours; the central space, black; and the intermediate space the pure colours, broken by the various proportions of black.

146. The diagram, as just described, thus represents the lowering of pure colours by white, and their gradation by black; their modifications by their mutual mixtures, the modification of hues, and the modification of breaking. We will presently inquire into the possibility of realizing it by means of coloured materials.

147. We have presumed—1. That the normal tone of each of the scales is as pure as possible. 2. That the tones bearing the same number in all the scales, —both those of the pure colours and those of the broken colours,—are, to the sight, of equal depth. 3. That if three tones, of the same number, be taken in three consecutive scales, the tone of the intermediate scale is the mean between the colours of the extreme scales. It is thus easy to explain the modifications of a pure colour commencing with its normal tone.

148. These modifications are so produced that— 1. *The Pure Colour never leaves its Scale.*—The modification is in the direction of the radius of the circle—

proceeding from the normal tone towards the centre, it gains white; while proceeding from the normal tone towards the circumference, it gains black.

149. 2. *The Pure Colour leaves its Scale by the addition of Black.*—In this case the various scales comprised in the quadrant perpendicular to the circle, begin at the normal tone of one of the pure scales of the circle with which the quadrant coincides. This normal tone, resulting from a quantity of colour represented by unity, covering a unit of surface *s*, the normal tones of the quadrant result from the mixture of black and a fraction of unity of the colour. These mixtures constitute broken colours, each covering a unit of surface *s*, and are of the same depth as the normal tone of the pure colour. The fraction of the quantity of colour is, in the broken normal tones, so much less, as the scales, to which these tones belong, approximate to the vertical axis of the semicircle.

Besides, each normal tone of the scales of the quadrant is modified, like the normal tones of the scales of the circle, by increasing quantities of white towards the centre, and of increasing quantities of black towards the circumference.

150. 3. *A Pure Colour is modified by the addition of another Pure Colour.*—In this case hues are formed so much more resembling each other, as the quantities of the second colour are smaller. These modifications are made circularly, so that the tones retain their numbers. Thus admitting, with painters and dyers, that there are only three primary colours, and that by combining these two by two, we obtain all the pure complex colours; and by combining them in threes, all the broken

colours; we find that it is possible to represent by this hypothesis, all the modifications of colours.

151. Another advantage of this construction is that of giving to all artists who may make applications of the law of simple contrast, the complementaries of all the pure colours; since the colours of the circular plan which are found at the extremities of the same diameter are complementary to each other. For example, not only are red and green, blue and orange, yellow and violet on the same diameter, but it is so with orange-red and bluish-green, and yellowish-green and violet-red; of red No. 1 and of green No. 1; so that all the colours opposed to each other are mutually complementary.

152. The complementary of a colour contiguous to another being once known, it is easy, according to the principles of combination, to determine the modification that the second must receive from the first; since this modification is the result of the mixture of the complementary with the contiguous colour. In fact, if there is no difficulty when the result is that of the non-complementary mixture with a simple colour, red, yellow, and blue, with a binary colour, orange, green, violet (using the language of painters, 76), there is no greater difficulty when the result is that of the mixture of two binary colours. For, the complementary being much less intense than the colour with which it is mixed, the result will be found by subtracting from the last binary colour the portion of its simple colour, which with the complementary forms white, or in other words, neutralises it.

153. *Examples.*—1. Orange being added as a complementary to green, neutralises a portion of its blue, and consequently makes it appear less blue or more yellow.

2. Orange being added as complementary to violet, neutralises a portion of its blue, and consequently makes it appear less blue or more red.

3. Green being added as complementary to violet, neutralises a portion of its red, and consequently makes it appear less red or more blue.

154. These three examples are easily explained by subtracting from the binary colour a portion of its simple colour which is identical with that contiguous to it. Thus :—

1. Blue subtracted from Green, makes it appear more Yellow.
2. Blue „ „ Violet „ „ Red.
3. Red „ „ Violet „ „ Blue.

155. To put the diagram into practice we must adopt invariable types of colour, either in the solar spectrum, or in polarized light, or coloured rings, or colours developed in a constant manner, by any process whatever; then imitate them with the utmost fidelity, by means of colouring matters which should be applied to the circular plan of our chromatic diagram.

These types must be sufficiently numerous to reproduce the principal colours, in order that a practised eye may without difficulty insert all the tones of the same scale and all the hues of which types are wanting. In fact the diagram thus established, should present terms so near that the various colours of the natural bodies might be referred to them.

156. 1. *That it represents all the Modifications resulting from the Mixture of Colours.* — Thus any colour lowered by white and deepened with black may, retaining its place in the scale, give rise to an infinite variety of tones; infinite, inasmuch as an unlimited number may be inserted from tone 1 to tone 20.

157. 2. Pure colours, by their mutual modifications, may produce an infinite variety of hues; for between two adjacent hues we may insert as many as we desire.

158. 3. The normal tone of a pure colour represented by a quantity equal to 1, covering the unit of surface, is the commencement of the normal tones and scales proceeding towards black; these normal tones being represented by black and a quantity of colour less than unity, constituting the mixtures which cover a unit of surface *s*, and colour it of a tone which has the same number as the normal tone of the pure scale to which it relates. It is understood that in proceeding from this tone to the corresponding tone of normal black, we may insert an unlimited number of mixtures of colour and black.

159. The modifications of colours, thus indicated by the diagram, render it extremely easy to understand the definitions given above (123) of the words, scales, tones, hues, pure and broken colours.

160. 2. *It affords the means of knowing the complementaries of every colour, since the names written at the two extremities of any one diameter indicate the colours complementary to each other.*

161. Examples.—*a.* Suppose it be required to know the mutual influence of *blue and yellow;* at one extremity of a diameter we read the word *blue*, and at its opposite end, the word *orange;* showing that blue tends to give orange to yellow. Again, at the end of another diameter we read the word yellow, and at its opposite, the word violet; by which we see that yellow tends to give violet to blue.

162. *b.* Suppose *green and blue* be contiguous; at one extremity of a diameter we read the word green, and at its opposite end, red; showing that green tending to

give red to blue, must render it more violet. Again, at one end of a diameter we read the word blue, and at its opposite end, orange. But what arises from the mixture of green and orange? The orange will tend to neutralize its complementary, blue, in the green; and as it is always too feeble to neutralize all the blue, its influence will be limited to neutralizing a portion of it; whence it results that green, contiguous to blue, will appear more yellow than it really is.

163. *c.* Let *green and yellow* be contiguous, we shall see in like manner that the green, by imparting red to the yellow, will render it orange; and that violet, the complementary of yellow, by neutralizing some yellow in the green, will make the green appear bluer, or less yellow.

164. 3. *A third advantage of this diagram, which distinguishes it from other chromatic diagrams, is, that it affords the preceding advantages, without being coloured.*

165. 4. *A fourth advantage is that of its manifesting to all artists who use coloured materials of a definite size, especially the workers of tapestry, carpets and the like, the relation of number which must exist between the tones of the various scales which they work together.*

SECTION III.

Harmony of Colours.

166. The eye has an undoubted pleasure in seeing colours, independently of the design and every other quality of the object which displays them. A suitable example to demonstrate this, is the wainscoting of an apartment in one or more flat tints which only attract

the eyes and affect them more or less agreeably, as the colours are well or badly chosen.

167. First Case. *Agreeable Colour.*—Every one, whose eyes are well organized, derives pleasure from looking at the coloured rays transmitted through a coloured glass, whether it be red, orange, yellow, green, blue, or violet.

168. Second Case. *Different Tones of the same Scale of Colour.*—The simultaneous view of the series of tones of the same scale, which commences with white and ends with dark brown, gives undoubtedly an agreeable sensation, especially if the tones have equal and sufficiently numerous intervals; for example, from eighteen to thirty.

169. Third Case. *View of Different Colours, belonging to adjacent Scales, assorted conformably to Contrast.*—The simultaneous view of different colours, belonging to scales more or less allied to each other, may be agreeable; but the assortment of scales producing this effect is very difficult to obtain, because the more nearly the scales approach, the more frequently it happens that one of the colours injures that which is adjacent to it, and even both are reciprocally injurious. The painter may, however, take advantage of this harmony, by sacrificing one of the colours, which he subdues, to make the other more brilliant.

170. Fourth Case. *View of very different Colours, belonging to very distant Scales, arranged conformably to Contrast.*—The simultaneous view of complementary colours, or of binary assemblages of colours, which, without being complementary, are yet very different, is also an undoubtedly agreeable sensation.

171. Fifth Case. *View of various Colours, assorted*

more or less according to the Law of Contrast, being seen through a glass of a colour not deep enough to allow all the colours peculiar to the glass to be visible, afford a spectacle which is not without its charm, and which is placed between that produced by the tones of the same scale, and that which is produced by various colours; for it is evident, that if the glass were of a deeper colour, it would cause objects to be seen of the colour peculiar to it.

172. Hence we infer that there are six distinct harmonies of colour, comprised in two species.

First Species—Harmonies of Analogy.—1. *The harmony of scale,* produced by the simultaneous view of different tones of the same scale, more or less approximating. 2. *The harmony of hues,* produced by the simultaneous view of tones of the same, or nearly of the same depth, belonging to neighbouring scales. 3. *The harmony of a dominant coloured light,* produced by the simultaneous view of various colours assorted according to the law of contrast, but one of them predominating, as would result from the view of these colours through a slightly-coloured glass.

173. Second Species—Harmonies of Contrast.—1. *The harmony of contrast of scale,* produced by the simultaneous view of two very distant tones of the same scale. 2. *The harmony of contrast of hues,* produced by the simultaneous view of tones of different depths, belonging to neighbouring scales. 3. *The harmony of contrast of colours,* produced by the simultaneous view of colours, belonging to very distant scales, assorted according to the law of contrast. The difference in the depth of the adjacent tones may further augment the contrast of colours.

SECTION IV.

Assortments of Red, Orange, Yellow, Green, Blue, Violet with White, Black, and Grey.

174. It will not be useless to the object of this work to introduce some observations relative to the degree of beauty of certain arrangements of the primitive colours with black, white, and grey. But I cannot too strongly insist upon the fact, that they are not given as a rigorous deduction from scientific rules, for they are only the expression of my particular taste; yet I hope that many classes of artists, especially dressmakers, decorators of all kinds, designers of patterns for woven fabrics, paper-hangings, &c., will find advantage in consulting them.

175. The *ground*, as well as the interval between the colours, having influence upon their effect, all my observations were made with white, black, grey, and coloured circles, $\frac{4}{10}$ of an inch in diameter, separated by intervals of $\frac{4}{10}$ of an inch; thirteen circles arranged in a straight line forming a series.

176. The series designed to show the effect of white were on a ground of normal grey; those to show the effect of black and of grey were upon a white ground, slightly tinged with grey. It is necessary to remark that the *coloured* circles placed apart, were upon black grounds, which must have exercised some influence.

177. The colours which have been under my notice are red, orange, yellow, green, blue, violet. Their differences in regard to brilliancy are so great as to admit of their being divided into two groups, one comprising red, orange, yellow, and bright green, the other blue and violet, which, with the same depth of tone, have not the brilliancy of the former. I shall call the first group

luminous colours, and the second *sombre colours*. But the deep and broken tones of the *luminous* scales may in many cases be assimilated to the sombre group, as the light tones of blue and violet may sometimes be employed as *luminous* colours.

Article I.

Colours with White.

Plate 8.

A. *Binary Assortments.*

178. All the primary colours gain by their juxtaposition with white, but the binary arrangements which result from them are not equally agreeable; and it is to be remarked that the depth of tone of a colour has a great influence upon the effect of its assortment with white.

The binary assortments in the order of their greatest beauty, are as follows:—*light blue* and white, *rose* and white, *deep yellow* and white, *bright green* and white, *violet* and white, *orange* and white.

Dark blue and dark red produce, with white, too strong a contrast of tone to allow of their assortment being as agreeable as that of their light tones. On the contrary, yellow being a light colour, we must take the normal or deepest tone of yellow to produce its most beautiful effect. Dark green and violet contrast too much in tone with white for their combination to be as agreeable as those which are made with the light tones of these colours. The objection which can be made to the combination of orange and white is that of too much brilliancy; yet I should not be surprised to find that many persons preferred it to that of violet and white.

B. *Tertiary Assortments of Colours complementary to each other with White.*

179. It is to me impossible to establish an order of beauty among binary combinations of primary comple-

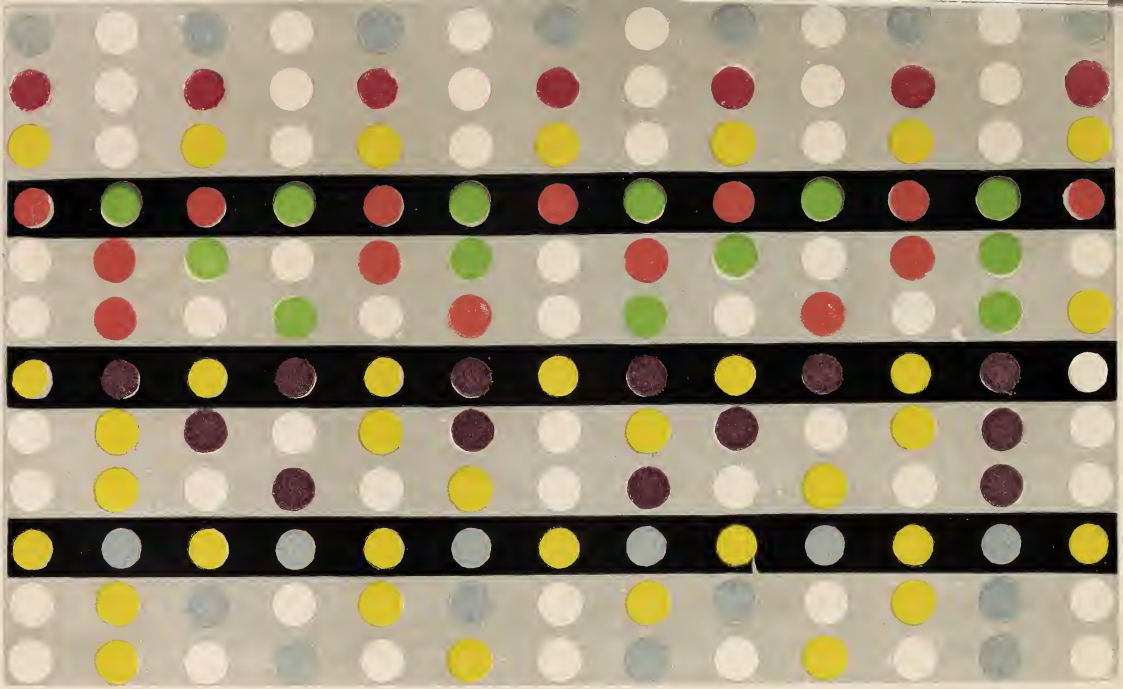


PLATE VIII.

mentary colours. I shall therefore only describe the effect of white interposed between the binary complementary assortments, or between each of the complementary colours.

180. 1. *Red and Green* are of all complementary colours the most equal in depth; for red, as regards its brilliancy, is midway between yellow and blue; and in green these two extremes are united. 2. The arrangement, white, red, green, white, &c., is not decidedly superior to the preceding, at least when the colours are not deep. 3. The arrangement white, red, white, green, white, &c., seems to me inferior to the preceding.

181. 1. *Blue and Orange* are more opposed to each other than red and green, because the least brilliant colour blue, is separated, while the most brilliant are combined in orange. 2. The arrangement, *white, orange, blue, white,* &c., is agreeable. 3. The arrangement, *white, orange, white, blue,* white, &c., is also agreeable.

182. 1. *Yellow and Violet* form an arrangement which, as regards depth of tone, is most distinct, since the least intense or lightest colour, the yellow, is separated from the others. Because of this great contrast of tone, the deep, but pure, greenish-yellow combines better with light violet, than light yellow and deep violet. 2. The arrangement, white, yellow, violet, white, &c., appears to me inferior to the preceding arrangement (1). 3. The arrangement, white, yellow, white, violet, white, &c., seems to me inferior to 2.

C. *Ternary Assortments of Colours not complementary with White.*

183. 1. Red and orange do not accord well. 2. The arrangement, *white, red, orange, white,* &c., is scarcely preferable. 3. The arrangement, *white, red, white, orange,*

white, &c., is not so bad as the preceding, because white being favourable to all the colours, its interposition between the colours which injure each other, can only produce an advantageous effect.

184. *Red and Yellow* accord pretty well, especially if the red is purple-red rather than scarlet, and the yellow rather greenish than orange. 2. The arrangement, white, red, yellow, white, is preferable to the preceding. 3. The arrangement white, red, white, yellow, white, is still better.

185. 1. *Red and Blue* accord passably, especially if the red incline rather to scarlet than to crimson. Deep tones are preferable to light ones. 2. The arrangement *white, red, blue, white,* &c., is preferable to 1. 3. The arrangement *white, red, white, blue, white,* is preferable to the second.

186. 1. *Red and Violet* do not accord well, yet they are found in some natural productions, as the sweet pea. 2. The arrangement *white, red, violet, white,* is not so bad as the preceding. 3. The arrangement *white, red, white, violet, white,* is preferable.

187. 1. *Orange and Yellow* accord incomparably better than red and orange. 2. The arrangement *white, orange, yellow, white,* is agreeable. 3. The arrangement *white, orange, white, yellow, white,* is not so good as 2, and perhaps 1, because there is too much white.

188. 1. *Orange and Green* do not accord well. 2. The arrangement *white, orange, green, white,* is preferable to 1. 3. The arrangement *white, orange, white, green, white,* is perhaps preferable to 2.

189. 1. *Orange and Violet* accord passably, yet not so well as orange and green; the contrast, in the latter case, is greater than in the arrangement orange and

violet. 2. The arrangement *white, orange, violet, white,* &c., is preferable to the preceding. 3. The arrangement *white, orange, white, violet,* white, &c., is preferable to 2.

190. 1. *Yellow and Green* form an agreeable combination. 2. The arrangement white, yellow, green, white, &c., is still more agreeable. 3. The arrangement white, yellow, white, green, white, &c., is inferior to the preceding, and perhaps to the first. The inferiority of 3 seems to me to be caused by too much light for the green.

191. 1. *Yellow and Blue.* The arrangement of *yellow* and *blue* is more agreeable than that of yellow and green, but it is less lively. 2. The arrangement *white, yellow, blue, white,* &c., is perhaps preferable to the preceding. 3. The arrangement *white, yellow, white, blue,* &c., is perhaps inferior to the preceding.

192. 1. *Green and Blue* produce an indifferent effect, but better when the colours are deep. 2. The arrangement *white, green, blue, white,* &c., is preferable. 3. The arrangement *white, green, white, blue, white,* &c., has a still better effect, because the light is more equally distributed.

193. 1. *Green and Violet,* especially when light, form a combination preferable to the preceding, green and blue. 2. The arrangement white, green, violet, white, &c., is not decidedly superior to the preceding. 3. The arrangement, white, green, white, violet, white, &c., is not decidedly superior to it.

194. 1. *Blue and Violet* accord badly. 2. The arrangement, white, blue, violet, white, &c. is scarcely preferable to the preceding (1). 3. The arrangement white, blue, white, violet, white, &c., is not so bad as the preceding (2).

Article II.

Colours and Black.

Plate 9. (Frontispiece.)

195. I do not know whether the use of black for mourning, prevents the use of it, in numberless cases, where it would produce excellent effects; it may be combined most advantageously, not only with sombre colours to produce the harmony of analogy, but also with light and brilliant colours to produce the harmony of contrast.

196. Chinese artists appear to have made excellent use of it, for I have often seen furniture, painting, ornaments, &c., where it has been most judiciously employed. I recommend those artists for whom this paragraph is particularly designed, to attend to the following observations, not doubting that many will be profitable to them.

A. *Binary Combinations.*

197. No combination of primary colours with black is disagreeable, but there exists among these a generic difference of harmony, which is not shown, at least to nearly the same degree, in the binary combinations of white with the same colours. In fact the brilliancy of white is so predominant, that whatever may be the difference of lightness or brilliancy observed between the various associated colours, there will always be the harmony of contrast, according to what has been said (44—52) of the influence of white in raising the tone and augmenting the intensity of the colour adjacent to it.

198. If the binary combinations of black be examined in this point of view, it will be seen that the deep tones of all the scales, and even of the blue and violet scales (which are not, properly speaking, deep), form with it harmonies of analogy and not of contrast. So likewise

do the unbroken tones of the red, orange, yellow-green scales, and the very light tones of the violet and blue scale. We may add, according to what has been said (55), that the combinations of black with sombre colours, such as blue and violet, whose complementaries, orange and greenish-yellow, are luminous, may diminish the contrast of tone if the colours be juxtaposed with black or one not far from it, and in this case the black loses much of its vigour.

199. Blue and Black, Violet and Black, make combinations which may be employed successfully when only dark colours are required. The first is superior to the second.

200. Light combinations which exhibit the harmonies of contrast, appear to me in the order of beauty thus :—

Red or *Rose* and *Black*, *Orange* and *Black*, *Yellow* and *Black*, lastly, *Bright-Green* and *Black*. As to yellow, I repeat that it must be brilliant and intense, inasmuch as black tends to impoverish its tone.

B.—*Ternary Combinations of Colours mutually Complementary with Black.*

201. 1. *Red, Green,* &c. 2. *Black, Red, Green, Black,* &c. This arrangement being quite different from the former, it is difficult to decide respecting their comparative beauty. 3. *Black, Red, Black, Green, Black,* &c., appear to me inferior to the preceding, because there is too much black.

202. 1. *Blue, Orange,* &c. 2. *Black, Blue, Orange, Black.* I prefer the first to the second ; the proportion of dark colour being too strong relatively to the orange. 3. *Black, Blue, Black, Orange, Black,* &c. This pleases me less than the first.

The effect of black with blue and orange is inferior to that of white.

203. 1. *Yellow, Violet,* &c. 2. *Black, Yellow, Violet,* &c. 3. *Black, Yellow, Black, Violet, Black,* &c. The second is superior to the third, because the proportion of sombre colours with the yellow is too strong in the latter. The first appears to me superior to the second.

C.—*Ternary Combinations of Colours not Complementary with Black.*

204. 1. *Red, Orange,* &c. 2. *Black, Red, Orange, Black,* &c. 3. *Blak, Red, Black, Orange, Black,* &c. As orange and red injure each other, there is an advantage in separating them by black. The third arrangement is preferable to the second ; and both are preferable to those in which black is replaced by white.

205. 1. *Red, Yellow,* &c. 2. *Black, Red, Yellow, Black.* 3. *Black, Red, Black, Yellow, Black,* &c. The two last arrangements appear to me superior to the first, and many persons would prefer them to the arrangement in which white replaces black. I cannot too strongly recommend the arrangement 2 and 3 to artists, for whom these observations are especially designed.

206. 1. *Red, Blue,* &c. 2. *Black, Red, Blue, Black.* 3. *Black, Red, Black, Blue, Black,* &c. No. 2 is preferable to No. 3, because there are too many sombre colours in the latter, and because these differ too much from the red. The effect of black upon the binary arrangement, red and blue, is inferior to that of white.

207. 1. *Red, Violet,* &c. 2. *Black, Red, Violet, Black,* &c. 3. *Black, Red, Black, Violet, Black,* &c. The red and violet injure each other, it is therefore advantageous to separate them by black ; but the latter does not produce so good an effect as white. It is diffi-

cult to say whether No. 3 is preferable to 2; because, if there be in the latter red near violet, this defect is more than compensated in 3, by the predominance of sombre colours over the red.

208. 1. *Orange-Yellow*, &c. 2. Black, Orange-Yellow, &c. 3. Black, Orange, Black, Yellow, Black, &c. The orange and yellow being very luminous, the black allies itself to them very well in the arrangement 2 and 3; and if the arrangement, white, orange, yellow, white, be preferred to No. 2, I think that in the arrangement 3, the black produces a superior effect to the white.

209. 1. *Orange, Green*, &c. 2. *Black, Orange, Green*, &c. 3. *Black, Orange, Black, Green, Black*, &c. Black combines well with orange, and with bright green. In like manner it combines well with orange and yellow. If, in the arrangement 2, white be preferred to black, I think it cannot be in 3. I recommend to artists the combination of black with the binary arrangements orange and yellow, orange and green.

210. 1. *Orange, Violet*, &c. 2. *Black, Orange, Violet, Black*, &c. 3. *Black, Orange, Black, Violet, Black*, &c. Black does not combine so well as white with orange and violet, because the proportion of dark colours relatively to orange, a very vivid colour, is too great.

211. 1. *Yellow, Bright Green*, &c. 2. *Black, Yellow, Green, Black*, &c. 3. *Black, Yellow, Black, Green, Black*, &c. Yellow and light green being luminous colours, black combines very well with them; and if in the arrangement 2 the effect of white be preferred to that of black, I think that it cannot be in the arrangement 3.

212. 1. *Yellow, Blue*, &c. 2. *Black, Yellow, Blue, Black*, &c. 3. *Black, Yellow, Black, Blue, Black*, &c. If the

arrangement 2 be preferable to 3, I think it inferior to 1. The black does not appear to combine so well as the white in the group yellow and blue.

213. 1. *Green, Blue,* &c. 2. *Black, Green, Blue, Black,* &c. 3. *Black, Green, Black, Blue, Black,* &c. Although green and blue do not well accord, yet the combination with black is not decidedly advantageous. Because of the augmentation of the proportion of sombre colours, the white has a superior effect to the black.

214. 1. Green, Violet, &c. 2. Black, Green, Violet, Black. 3. Black, Green, Black, Violet, Black, &c. If the black unite better with green and violet than with green and blue, yet these ternary combinations are inferior to the binary combinations; and inferior to the ternary combination where it is replaced by white.

215. 1. Blue, Violet, &c. 2. Black, Blue, Violet, Black, &c. 3. Black, Blue, Black, Violet, Black, &c.

216. Although blue and violet are colours which do not accord well, and although there is an advantage in separating them, yet it must be remembered that black in isolating them, does not relieve their sombre colour, but, on the other hand, the harmony of the arrangements of 2 and 3 is more agreeable as a harmony of analogy than the harmony of contrast presented by white with the same colours. Thus there are cases in which the assemblage of black, blue, and violet, may be advantageous, when it is desired to produce diversified, but not striking effects.

Article III.

Colours with Grey.

Plate 10.

217. All the primary colours gain purity and brilliancy by the proximity of grey; yet the effects are far

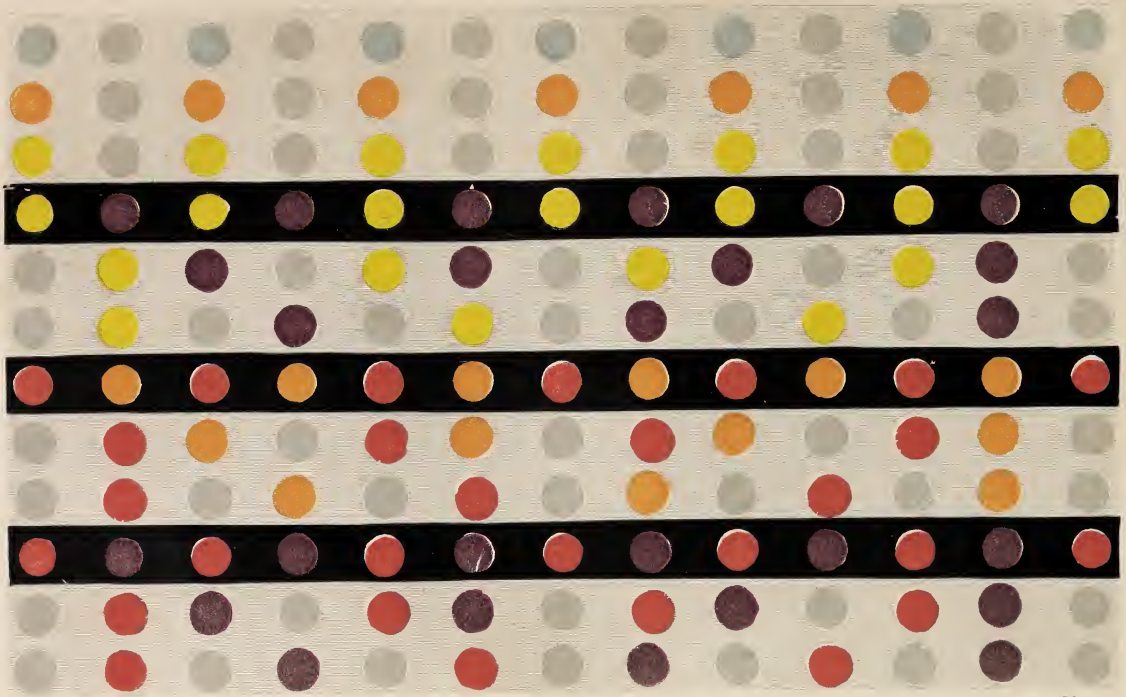


PLATE X.

from being like or even analogous to those which result from the proximity of the same colours with white. This will not create surprise, if it be remembered that while white preserves the character of each colour and exalts it by contrast, it can never be taken for a colour properly so called; grey, on the contrary, may be; it happens that the latter makes with the most sombre colours, as blue, violet, and deep tones in general, assortments which belong to the harmonies of analogy; while, with colours naturally brilliant, such as red, orange, yellow, and the light tones of green, they form analogies of contrast. But, although white contrasts more with sombre colours than with those that are naturally luminous, there is not observed between white and those two kinds of colours the difference observable between grey and the same colours. This result confirms what I have said of the binary combinations of black. (203.)

A.—*Binary Combinations.*

218. *Grey and Blue, Grey and Violet*, form arrangements of which the harmony of analogy is agreeable, yet less so than that of black with the same colours.

219. *Grey and Orange, Grey and Yellow, Grey and Bright Green*, form equally agreeable arrangements of harmony of contrast; perhaps they are less so than those in which grey is replaced by black.

220. *Grey and Rose* are a little dull and inferior to *Black and Rose.* All the binary arrangements of grey, except, perhaps, that of orange, are inferior to those of white.

B.—*Ternary Combinations of Complementary Colours with Grey.*

221. *Red, Green, &c.*—1. Red, Green, &c. 2. Grey, Red, Green, Grey, &c. 3. Grey, Red, Grey, Green,

Grey, &c. If it be doubtful whether the binary assortment of grey, red, and green, be favourable, it cannot be called injurious. The third assortment is, perhaps, inferior to that in which the grey is replaced by black.

222. *Blue and Orange.*—1. Blue, Orange, &c. 2. Grey, Blue, Orange, Grey. 3. Grey, Blue, Grey, Orange, Grey, &c. I prefer the first arrangement to the two others.

223. *Yellow and Violet.*—1. Yellow, Violet, &c. 2. Grey, Yellow, Violet, Grey, &c. 3. Grey, Yellow, Grey Violet, Grey, &c. Although the arrangements 2 and 3 are lighter than the arrangements in which grey is replaced by black, yet the binary arrangement appears to me preferable to the ternary.

Ternary Assortments of Colours not Complementary to each other with Grey.

224. *Red and Orange.*—1. Red, Orange, &c. 2. Grey, Red, Orange, Grey, &c. 3. Grey, Red, Grey, Orange, Grey, &c. The arrangements 2 and 3 are preferable to the binary. The third is preferable to the second. In short, the grey produces, with red and orange, a better effect than white, but the effect is inferior to that of black.

225. *Red and Yellow.*—1. Red, Yellow, &c. 2. Grey, Red, Yellow, Green, &c. 3. Grey, Red, Grey, Yellow, Grey, &c. Although the grey combines well with the red and the yellow, it has not so decidedly advantageous an effect as black in the binary arrangement.

226. *Red and Blue.*—1. Red, Blue, &c. 2. Grey, Red, Blue, Grey, &c. 3. Grey, Red, Grey, Blue, Grey, &c. The arrangement 2 is preferable to 3. I

dare not say to 1. The effect of grey is inferior to that of white.

227. *Red and Violet.*—1. Red, Violet, &c. 2. Grey, Red, Violet, Grey, &c. 3. Grey, Red, Grey, Violet, Grey, &c. The assortment 3 appears to me superior to 2, and the second to the first; but it is difficult to say whether grey is superior to black. I am certain it is superior to white.

228. *Orange and Yellow.*—1. Orange, Yellow, &c. 2. Grey, Orange, Yellow, Grey, &c. 3. Grey, Orange, Grey, Yellow, Grey, &c. The assortment 3 appears to me preferable to 2; the harmony of contrast is less intense than with black. The assortment 3 is, perhaps, superior to the assortment of white, orange, white, yellow, white.

229. *Orange and Green.*—1. Orange, Green, &c. 2. Grey, Orange, Green, Grey, &c. 3. Grey, Orange, Grey, Green, Grey, &c. Grey combines well with orange and green, but it does not contrast so agreeably as black or white.

230. *Orange and Violet.*—1. Orange, Violet, &c. 2. Grey, Orange, Violet, Grey, &c. 3. Grey, Orange, Grey, Violet, Grey, &c. The binary assortment appears to me preferable to the other two. The assortment 2 is preferable to 3. If the grey is a little dull with orange and violet, it has not the same disadvantage as black, in causing too great a predominance of sombre colour.

231. *Yellow and Green.*—1. Yellow, Green, &c. 2. Grey, Yellow, Green, Grey, &c. 3. Grey, Yellow, Grey, Green, Grey, &c. Grey combines well with yellow and green, but the assortments 2 and 3 are a little dull, and inferior to those in which black replaces grey.

232. *Yellow and Blue.*—1. Yellow, Blue, &c. 2. Grey, Yellow, Blue, Grey, &c. 3. Grey, Yellow, Grey, Blue, Grey, &c. The two assortments, two and three, are inferior to the first. The grey is heavy to yellow and blue; its effect is inferior to that of white, and perhaps also to that of black.

233. *Green and Blue.*—1. Green, Blue, &c. 2. Grey, Green, Blue, Grey, &c. 3. Grey, Green, Grey, Blue, Grey, &c. Grey, in its combination with green and blue, has not the same objection as black, but it has an inferior effect to white.

234. *Green and Violet.*—1. Green, Violet, &c. 2. Grey, Green, Violet, Grey, &c. 3. Grey, Green, Grey, Violet, Grey, &c. Grey is not employed advantageously with green and violet, it is inferior to white in the ternary arrangements, and perhaps I should also give preference to black.

235. *Blue and Violet.*—1. Blue, Violet, &c. 2. Grey, Blue, Violet, Grey, &c. 3. Grey, Blue, Grey, Violet, Grey, &c. The remarks made (218) in the assortment of black with blue and violet are applicable to the arrangement with grey, taking into account the difference of tone which exists between grey and black.

Recapitulation.

236. I will now give a summary of the observations which appear the most striking on reading the foregoing paragraphs, premising, however, that I do not pretend to establish laws fixed upon scientific principles, but to state general propositions which express my own peculiar taste.

237. 1st. *In the harmony of contrast the complementary arrangement is superior to every other.*

The tones must be as nearly as possible of the same depth to produce the finest effect. The complementary arrangement in which white associates most advantageously, is that of blue and orange, and that of yellow and violet is the least advantageous.

238. 2nd. *The Primaries, Red, Yellow, and Blue associated in pairs assort better together, as a harmony of contrast, than an arrangement formed of one of these primaries, and of a binary colour in juxtaposition with it, having the same primary as one of its elements.*

Examples.

Red and Yellow	accord	better than	Red and Orange.
Red and Blue	„	„	Red and Violet.
Yellow and Red	„	„	Yellow and Orange.
Yellow and Blue	„	„	Yellow and Green.
Blue and Red	„	„	Blue and Violet.
Blue and Yellow	„	„	Blue and Green.

239. 3rd. *The arrangement of Red, Yellow, or Blue with a binary colour containing the former, contrasts the better, as the simple colour is essentially more luminous than the binary.*

Whence it follows, that in this arrangement, it is an advantage for the red, yellow, or blue to be of lower tone than the binary colour.

Examples.

Red and Violet	accord	better than	Blue and Violet.
Yellow and Orange	„	„	Red and Orange.
Yellow and Green	„	„	Blue and Green.

240. 4th. *When two colours accord badly together, it is always advantageous to separate them by White.*

In this case it is more advantageous to place each colour next to white, than in an assortment where the two colours are together beside white.

241. 5th. *Black never produces a bad effect when it is associated with two luminous colours. It is therefore often preferable to White, especially in an assortment where it separates the colours from each other.*

Examples.

1. Red and Orange.

Black is preferable to white in the arrangements 2 and 3 of these two colours. 2. Red and Yellow. 3. Orange and Yellow. 4. Orange and Green. 5. Yellow and Green.

Black, with all these binary assortments, produces harmony of contrast.

242. 6th. Black in combination with sombre colours, such as blue and violet, and with broken tones of luminous colours, produces harmony of analogy, which, in many instances, may have a good effect.

The harmony of analogy of black, associated with blue and violet, is preferable to the harmony of contrast of the assortment white, blue, violet, white, &c., the latter being too crude.

243. 7th. Black does not accord so well with two colours, one of which is luminous, the other sombre, as when it is associated with two luminous colours. In the first instance the combination is so much the less agreeable as the luminous colour is more brilliant.

With all the following assortments Black is inferior to White. 1. Red and Blue. 2. Red and Violet. 3. Orange and Blue. 4. Orange and Violet. 5. Yellow and Blue. 6. Green and Blue. 7. Green and Violet.

With the assortment yellow and violet, if it is not inferior to white, it produces only a mediocre effect.

244. 8th. Although *Grey never produces exactly a bad effect in its association with two luminous colours, yet in most cases its assortments are dull, and it is inferior to Black and White.*

Among the assortments of two luminous colours, there are scarcely any besides those of red and orange with which grey associates more happily than white. But it is inferior to it, as also to black, in the arrangements red and green, red and yellow, orange and yellow, orange and green, yellow and green. It is also inferior to white, with yellow and blue.

245. 9th. *Grey, in combining with sombre colours, such as Blue and Violet, and with broken tones of luminous colours, produces harmonies of analogy, which have not the vigour of those with black; although the colours do not combine well together, it has the advantage of separating them from each other.*

246. 10th. *When Grey is associated with two colours, one of which is luminous the other sombre, it will perhaps be more advantageous than White, if this produces too strong a contrast of tone; on the other hand, it may be more advantageous than Black, if that increases too much the proportion of sombre colours.*

Examples.

Grey associates better than Black with—

1. Orange and Violet. 2. Green and Blue. 3. Green and Violet.

247. 11th. If, when two colours accord badly, there is in principle an advantage in separating them by White, Black, or Grey, it is important to the effect to take into consideration—1. The height of tone of the colours. 2. The proportion of sombre to luminous colours, including, in the first, the broken brown tone of the brilliant scales, and in the luminous colours, the light tones of the Blue and Violet scales.

Consider the height of tone of the colours.

248. The effect of white with red and orange is inferior as their tones become higher, especially in the assortment white, red, orange, white, &c.; the effects of the white being too crude. On the contrary, black unites very well with the normal tones of the same colours, that is to say, the highest tones without any mixture of black. Although grey does not associate so well as black with red and orange, it has the advantage of producing a less crude effect than white.

Consider the proportion of sombre to luminous colours.

249. Whenever colours differ very much, either in tone or in brilliancy, from the black or white with which we wish to associate them, that arrangement where each of the two colours is separated from the other by black or white, is preferable to that in which the black or the white separate each pair of colours. Thus the assortment white, blue, white, violet, white, &c., is preferable

to the assortment white, blue, violet, white, &c., because the separation of the brilliant from the sombre is more equal in the first than in the second. I should add that this is somewhat more symmetrical as to the position of the two colours, and the principle of symmetry influences our judgment of things more than is generally recognised. It is also in conformity with the above, that the assortment black, red, black, orange, black, &c., is preferable to the assortment black, red, orange, black, &c.

250. Some remarks appear to me also necessary to prevent false deductions from the above propositions. In the preceding examples, the colours, including white, black, and grey, are supposed to occupy an equal extent of surface, and to be placed at equal distances apart, for without these conditions the results will be different; for example, I have preferred the assortment white, red, white, yellow, white, to the assortment white, red, yellow, white. There are some cases in which the latter is preferable to the former, as in the arrangement of flowers in gardens, especially yellow and rose flowers, which present less coloured surface than the white flowers with which they are associated.

251. I have spoken of the good effects of black and green separated, and I may add that green designs upon a black ground are also agreeable; but it does not follow that black lace upon a green stuff will have a good effect, at least on the optical quality of black, for this acquires a rusty tint, which resembles a faded colour.

252. The more colours are opposed, the easier it is to assort them; because they do not experience by their mutual juxtaposition, any modification which renders them disagreeable, as generally happens to colours which

are very nearly alike. Must we then conclude that with two colours which have in this case been indicated to an artist to be employed, with some liberty to modify them, he should endeavour to increase the effect of contrast rather than that of analogy? Certainly not; for frequently the latter is preferable to the former. For example:—Take orange-red and a pure red, instead of increasing the yellow in the orange-red, or of giving a violet hue to the red, it sometimes will be preferable to incline towards the harmony of scale or of hue, by endeavouring to make the orange one of the light tones of a scale whose red will be brown.

253. In conformity with this manner of observing, when we would avoid the bad effect of two adjacent colours by white, black, or grey, we must see whether, instead of a harmony of contrast, it may not be better to obtain the harmony of analogy.

254. Finally, when we bring into combination not normal grey, but a coloured grey, we are always sure of obtaining an effective harmony of contrast by taking a grey coloured with a complementary of that opposed to it. Thus an orange-grey or carmelite-brown or maroon has a good effect with light blue.

First Division.

Imitation of Coloured Objects with Coloured Materials in a State of Infinite Division.

INTRODUCTION.

255. Coloured materials, such as Prussian-blue, chrome-yellow, vermilion, &c., are infinitely divided, so to speak, either when ground pure, or mixed with a white material, in a gummy or oily liquid.

The reproduction of the images of coloured objects with these pigments is called the *Art of Painting.*

256. There are two systems of Painting—the one consists in representing as accurately as possible upon a flat surface an object in relief in such a way that the image makes an impression upon the eye of the spectator similar to that which the object itself would produce. This is termed the *Art of Chiaro-'scuro.*

257. There is a means of imitating coloured objects much simpler in its facility of execution than the preceding. It consists in tracing the outline of the different parts of the model, and in colouring them uniformly with their peculiar colours. There is no relief, no projection; it is the plane image of the object, since all the parts receive a uniform tint: this system of imitating is *Painting in Flat Tints.*

PAINTING ON THE SYSTEM OF CHIARO-'SCURO.

258. Are the modifications perceived in a single-coloured object, for example, in a blue or red stuff, &c., indeterminable, when these draperies are seen as draperies of a vestment or furniture, with more or less distinct folds, or are they determinable, in given circumstances? This is a question of which I am about to attempt a solution.

259. Firstly, let us distinguish three circumstances in which modifications of colours may be observed :—

1. Modifications produced by coloured lights falling upon the model.

2. Modifications produced by two different lights—as, for example, the light of the sun and diffused daylight—each illuminating different parts of the same object.

3. Modifications produced by diffused daylight.

260. We will suppose that in the two first cases the lighted surfaces are plane, and that all their superficial parts are homogeneous, and in the same conditions, except that of light. In the third case, we shall consider the position of the spectator viewing an object lighted by diffused daylight, the surface of which is not so disposed as to act equally in all its parts upon the light which it reflects to the eye of the spectator.

261. Modifications produced by coloured lights.

Red rays falling on	Black	make it appear	Purple-black.
„	White	„	Red.
„	Red	„	Redder.
„	Orange	,	Redder.
„	Yellow	„	Orange.
„	Deep Green	„	Red-black.
„	Light Green	„	Reddish-grey.
„	Light Blue	„	Violet.
„	Violet	„	Purple.

262. Modifications produced by Orange light.

Orange rays falling on—		
Black	make it appear	Maroon, or Carmelite-brown.
White	„	Orange.
Orange	„	More vivid.
Red	„	Scarlet.
Yellow	„	Yellow-orange.
Light Green	„	Yellow-green.
Deep Green	„	Rusty-green.
Light Blue	„	Orange-grey.
Deep Blue	„	Grey, slightly Orange-grey.
Indigo Blue	„	Orange-maroon.
Violet	„	Red-maroon.

263. Modifications produced by Yellow light.

Yellow rays falling on—

	Black	make it appear	Yellow-olive.
„	White	„	Light Yellow.
„	Yellow	„	Orange-yellow.
„	Red	„	Orange.
„	Orange	„	Yellower.
„	Green	„	Greenish-yellow.
„	Light Blue	„	Yellow-green.
„	Deep Blue	„	Green-slate.
„	Indigo	„	Orange-yellow.
„	Violet	„	Yellow-maroon.

264. Modifications produced by Green light.

Green rays falling on—

Black	make it appear	Greenish-brown.
White	„	Green.
Green	„	More intense and brilliant.
Red	„	Brown.
Orange	„	Faint Yellow, a little Green.
Green	„	Greener, according to its depth.
Indigo	„	Dull Green.
Violet	„	Bluish-green Brown.

265. Modifications produced by Blue light.

Blue rays falling on Black make it appear Blue-black.

Black	„	White	„	Blue.
„	„	Blue	„	More vivid.
„	„	Red	„	Violet.
„	„	Orange	„	Brown, having a pale tint of Violet.
Blue	„	Yellow	„	Green.
„	„	Green	„	Blue-green.
„	„	Indigo	„	Dark-blue Indigo.
„	„	Violet	„	Dark-blue Violet.

266. Modifications produced by Violet light.

Violet rays falling on	Black	make it appear		Very faint Violet-black.
"	White	"		Violet.
"	Violet	"		Deeper Violet.
"	Red	"		Red-violet Purple.
"	Orange	"		Light Red.
"	Yellow			Brown, with a very slight tint of Red.
"	Green			Light Purple.
"	Blue	"		Fine Blue Violet.
"	Indigo	"		Deep Blue Violet.

267. It is understood that to represent the preceding phenomena exactly, we must take into account the facility with which coloured light penetrates every kind of glass, the more or less intense colour of the stuff, and the kind of scale to which the coloured stuff and that of the transmitted coloured light respectively belong.

268. These observations were made by partially exposing coloured stuffs to the sun's rays transmitted through coloured glasses. The portion of stuff not exposed to these rays, was lighted by the direct light of the sun. The portion of stuff which received the action of the coloured rays being exposed to diffused daylight, reflected also rays of that light which it would have reflected in case it had been protected from the influence of the rays transmitted to it through coloured glasses.

269. II. Modifications produced by two lights of different intensity.

270. 1. The modification by the light of the sun falling upon one part of the surface of a coloured body, while the other part is enlightened by diffused daylight.

2. The modification produced when two parts of the same object are unequally illuminated by diffused daylight.

An object lighted partly by the sun, and partly by diffused daylight.

271. To observe this kind of modification properly, let us expose to the sun a square piece of stuff A B, two and a-half inches broad (Plate I., fig 4) and place in the middle a piece of black wire *f, f'*; then put parallel to this, and in the middle between A and B, two wires *e, e'* and *g, g'*, of about three-tenths of an inch in width. The extremity *g'* is fixed upon a perpendicular plane, so high, that all the part B *f, f'* may be in shadow,

272. 1. *If the stuff is red,* the lighted portion A is more orange or less blue than the part B, which is in shade; and the portion *a* is more orange than the portion *a'*, as the portion *b* is bluer than the portion *b'*.

273. 2. *If the stuff is orange,* A is more orange or less grey than B; and the portion *a* is deeper, more vivid than *a'*, as *b* is more grey and duller than *b'*.

274. 3. *If the stuff is yellow,* A is more vivid, more orange than B; *a* is more so than *a'*, as *b* is duller than *b'*.

275. 4. *If the stuff is green,* A is less blue or more yellow than B; and *a* is of a yellower green than *a'*, as *b* is bluer than *b'*.

276. 5. *If the stuff is blue,* A is less violet and more

green than B; and *a* is greener than *a'*, as *b* is more violet or less green than *b'*.

277. 6. *If the stuff is indigo,* A is redder or less blue than B; and *a* is redder than *a'*, as *b* is deeper or bluer than *b'*.

278. 7. *If the stuff is violet,* A is less blue than B; and *a* is redder than *a'* as *b* is bluer than *b'*.

279. 2nd. Two contiguous parts of the same object unequally illuminated by the same light, when viewed simultaneously, differ from each other, not only in depth of tone, but also in optical composition of colour.

Place half-a-sheet of coloured paper (Plate I., fig. 5) upon the partition *b*, of a chamber receiving diffused daylight by a window *f*: place another half-sheet upon the partition *a*, in such a manner that it will be lighted directly by the diffused light, while the other is only indirectly lighted by reflection from the walls, floor, and ceiling: the diffused light thus reflected being only white light, then stand at *c*, so as to see both half-sheets at once. I shall designate that which is upon the partition *a*, and most lighted, by A, and the other, which is upon the partition *b*, and less lighted, by B.

These letters in the plate indicate the respective positions of the half-sheets.

280. The inference from these observations is, that the colour of the same body varies, not only in intensity of tone, but also of hue, according as it is lighted directly by the sun, by diffused daylight, or by diffused reflected light. This result must never be overlooked whenever we define the colours of material objects.

3rd. *Modifications produced by diffused daylight reflected by a surface all the parts of which are not in the same position relatively to the eye of the spectator.*

281. Distant bodies are rendered perceptible to the eye only in proportion as they radiate or reflect, or transmit the light which acts upon the retina.

According to the laws of reflection, it happens that those portions of a surface which are in relief, or hollow, must reflect the light in such a manner, that the eye of the spectator, in a given position, will see these parts very variously lighted, in respect to the intensity of reflected light, so that the parts of this surface will be, relatively to the eye, in the same condition as the homogeneous parts of a plane surface, which are illuminated by lights of unequal intensity.

There will be this difference, however, that the parts of the surface of a body which appears to us hollow, and especially in relief, being but feebly varied in the greater number of contiguous parts, there will be generally a gradual diminution of the effects observed in the case in which we have studied the modifications of two plane homogeneous surfaces, lighted by diffused lights of unequal intensity. The sphere presents a remarkable example of the manner in which light is distributed over a convex surface, relatively to the eye of an observer, who views it from a given position.

282. I shall not occupy myself with this gradation of white light, from parts illuminated to those which do not appear so. I regard only the principal modifications, and take for examples the cases where they are as evident as possible. These modifications can be reduced to the four following :—

First modification, produced by the maximum of white light which the surface of a coloured body is capable of reflecting.

283. Other things being equal, the more highly the surface of a body is polished, the more it will reflect white and coloured light. If we observe the surface of a stick of sealing-wax, suitably placed, we shall perceive a white stripe parallel to the axis of the cylinder, produced by so large a quantity of colourless reflected light that the red light reflected from this stripe is not appreciable by the eye. Thus the white light reflected by a coloured body may be of sufficient intensity to render the colour of the body in some of its parts imperceptible.

Second modification, produced by those parts of a coloured surface which send to the eye, in proportion to the coloured light, less white light than the other parts differently lighted, or differently placed in relation to the spectator.

284. When the eye sees certain parts of the surface of a polished or uniformly coloured object which reflects to it proportionally to the coloured light less of white light than the other parts, the first parts will appear in most cases of a more intense tone of colour than the second. We will cite the following :—

Example 1.—A cylinder of red sealing-wax presents, proceeding from the white stripe mentioned above, a red colour deeper in proportion as less white light reaches the eye. Thus, in a certain position where the white stripe appears to be in the middle of the cylinder, the part most lighted will appear coloured, reflecting a red inclining to scarlet, while that which is the least lighted reflects a red inclining to crimson.

Example 2.—If the eye is directed into a gold vase of sufficient depth, the gold does not appear yellow as on the exterior surface, but of a red orange ; because less

white light, in proportion to coloured light, reaches the eye in the first case than in the second. It is for this reason that the concave parts of gold ornaments appear redder than the convex.

Example 3.—The spiral thread of a piece of twisted silk or wool held perpendicularly before the eye, appears in the part opposite to the light, of a much more decided colour than on the rest of the surface.

Example 4.—The folds of bright draperies present the same modification to an eye properly placed; the effect is particularly remarkable in yellow silk stuffs, and in sky-blue; for we can easily understand that it is less marked when the stuffs are less bright and of dark colours.

Example 5.—There are some stuffs which appear to be of two tones of the same scale of colour, and sometimes also of two tones of two contiguous scales, although the weft and the warp of these stuffs are of the same tone and the same colour. The cause of this appearance is very simple; the threads which, parallel to each other, form the designs, are in a different direction to the threads which constitute the ground of the stuff. Hence, whatever may be the position of the spectator with regard to the stuff, the threads of the design will always reflect coloured and white light in a different proportion to that reflected by the threads of the ground, and, according to the position of a spectator, the design will appear to be lighter or darker than the ground.

Third modification.—The colour complementary to that of a coloured object developed in one of its parts, in consequence of simultaneous contrast.

285. A natural consequence of the law of simulta-

neous contrast in general, and of the effect of a colour upon grey and black in particular, is, that since the same object presents some parts more or less dark, contiguous to some parts where we see the colour peculiar to the object, the first parts will appear tinted with the complementary to this colour. But to observe this effect, it is necessary that the grey part should reflect to the eye white light, and little or none of the coloured light which the object naturally reflects.

Fourth modification, in a single coloured stuff.

286. For example, if the eye is directed towards a window which admits daylight, and a person clothed in a new blue coat, dyed with indigo or Prussian blue, be at the window, the eye will see one part of the coat will appear different from the other part, because the nap of the cloth is disposed in a contrary direction; one being of a fine blue, while the other is of an orange-grey, by the effect of contrast of the blue part with a part that reflects very little white light to the eye, without, or almost without, blue light.

287. But as the pile of the nap loses its regular position by wear, the cloth becoming dull and soiled, the coloured light is reflected irregularly from all points; and the effect is either absolutely destroyed or much weakened.

If the garment be of a deep green, the grey part will appear reddish; if it be of a violet, maroon, or claret, the grey part will appear yellow.

288. The complementary is only developed upon cloths of dark and sombre colours; thus red, scarlet, orange, yellow, and light blue garments do not exhibit

it, because they have always too much of the essential colour which is reflected. The modification occurs only when one of the parts is more strongly illuminated than the other by diffused light (279).

289. There is also one circumstance where the fourth modification will appear evident; it is when we look at a series of light tones—blues, rose, &c. (belonging to the same scale)—of a skein of silk or wool, placed upon an easel, that one-half of the same skein presents to the eye the threads disposed in a contrary direction to those of the other half. The half of the skein which does not reflect coloured light to the eye, appears tinted with the complementary of the other half which does reflect it.

290. Fourth modification in a stuff presenting a dark and a light tone belonging to the same scale.

If we place in juxtaposition a dark tone and a light tone of the same scale, well assorted, the light tone will appear of the colour complementary to the scale to which it belongs. This modification is too important to allow me to pass it over hastily.

291. When we look for several seconds on a fabric dyed with a coloured ground, and on which therefore patterns intended to be white, but which, owing to the imperfection of the process employed, have received a light tone of the colour of the ground, the patterns will appear of the colour complementary to the latter. Thus, upon a ground of yellow-chromate of lead, they will appear violet; upon a ground of orange-chrome, they will appear blue; upon a green ground, rose, &c. To dispel the illusion, and to recognise the true tint of the pattern, it is only necessary to cover the ground with a white paper so perforated as to leave visible only the pattern coloured like the ground.

The influence of a dark tone upon a feeble tone is such, that not only is the latter neutralized, but the place it occupies upon the cloth appears also tinted with its complementary colour.

292. From the preceding observations it follows that there may be a printed cotton, the design of which, although coloured, will appear to most eyes white, and not of the complementary of the ground. For those eyes which see it thus, the perception of the phenomenon of contrast will correct the imperfection of the art of the calico-printer.

293. In the Lectures upon Contrast, which I delivered in 1836, at the Gobelins, I remarked, that in applying paper (cut for the purpose) upon the lights of a blue drapery of the Virgin in a tapestry representing the Holy Family, after Raphael, they appeared of a light blue, although, when they were seen surrounded with darker tones, they appeared of an orange tint.

294. We can conceive without difficulty that if the modification is not manifested with monochromous objects of vivid colours, as yellow, scarlet, &c., it is because that part of the surface of these objects which reflects the least light to the eye, always reflects enough of its peculiar colour to neutralize the complementary which the coloured light of the illuminated portion tends to develope. I believe that this effect tends to enfeeble the coloured light of the shaded part.

295. Although, in this chapter, I do not propose to treat of the modifications shown by coloured stuffs with white designs ; yet, as it is a case so connected with the preceding considerations, I cannot avoid mentioning them in this place.

296. If we observe a sky-blue silk with white flowers, the weft of which is in an opposite direction to the weft of the blue ground, we shall see the flowers white, if they are placed in the most favourable manner to receive the white light reflected by them; while, in the contrary position, we shall see these flowers absolutely orange. There is still much white light reflected, but it is not sufficiently vivid to neutralize the development of the complementary of the ground.

PAINTING ON THE SYSTEM OF FLAT TINTS.

297. In painting by flat tints, the colours are neither shaded, blended together, nor modified by the coloured rays coming from the surrounding parts of the picture.

In pictures which belong to this kind of painting, the representation of the model is reduced to the observance of linear perspective, to the employment of vivid colours in the nearer parts, and of pale and grey colours in the more distant.

If the choice of contiguous colours has been made conformably to the law of simultaneous contrast, the effect of the colour will be greater than if it had been painted on the system of chiaro-'scuro.

298. In every instance where painting is an accessory, and not a principal feature, painting in flat tints is in every respect preferable to the other kind.

299. The essential qualities of painting in flat tints necessarily reside in the good choice of colours and well drawn outlines. These outlines contribute to render the impressions of colours stronger and more agreeable, when, circumscribing forms clothed in colours, they concur with

them in suggesting to the mind a graceful object, when even the imitation of it does not give a faithful representation.

300. We may, in conformity with what has been said, consider that painting in flat tints may be advantageously employed,

1. When the objects represented are at such a distance that the finish of an elaborate picture would disappear.

2. When a picture is an accessory, decorating an object whose use would forbid too elaborate finish, and which would also be too costly. Such are the paintings which ornament screens, work-boxes, tables, &c.; in this case the objects preferable as models, are those whose beauty of colours and simplicity of form are so remarkable as to attract the eye by simplicity of outline, and by vivid colours: such are birds, insects, flowers, &c.

SECTION III.

ON COLOURING IN PAINTING.

CHAPTER I.

On Colouring.

301. *True or absolute colouring* is the faithful reproduction in painting of the modifications that light enables us to perceive in the objects taken for models.

302. In the ordinary use of the word *colouring*, we

allude to the more or less perfect manner in which the painter has complied with the rules,

1. *Of aërial perspective.*
2. *Of the harmony of local colours, and of the colours of the different objects composing the picture.*

Article I.

Of Aërial Perspective.

303. We must not believe that the employment of many colours in a composition is indispensable to give the epithet of *colourist* to the artist, for in pictures painted in one colour only, the simplest of all, in which we only distinguish two colours including white, the artist may be honoured with the title of *colourist*, if his work presents lights and shades distributed as they are upon the model. To convince ourselves of the justice of the expression, it will suffice to remark that the model might very well appear to the painter coloured with a single colour, modified by light and shade. In the same sense this epithet may be applied to the engraver, who, by means of his burin, reproduces a picture as faithfully as possible, in respect both to the aërial perspective of its different planes, and to the relief of each particular object.

304. A painter who has faithfully reproduced the aërial perspective, with all its modifications of white and coloured light and of shades, has effected a *true or absolute colouring*, which, however, may not be universally deemed as perfect as that in which this quality of absolute colouring is not found, at least in the same degree of perfection.

Imperfectly faithful imitation.

305. *A painter may have perfectly seized upon all the modifications of white and coloured light, but in his imitation, some of these modifications are more strongly marked than in nature.*

It almost always happens that *true but exaggerated colouring* is more agreeable than absolute colouring; and that many persons who experience pleasure in seeing the modifications of exaggerated coloured light which a picture may exhibit, do not feel the same pleasure from the sight of a model, because the modifications corresponding to those which are imitated in excess are not sufficiently prominent to be evident to them. Besides the relish of the eye for an excess of an exciting cause, is essentially analogous to the inclination we have for food and drink of a pungent flavour and odour.

306. A painter may have perfectly seized all the modifications of light which bring forward the planes and the relief of objects; the modifications of the coloured light of his picture may be true, but the colours may not be those of his model. As in pictures in which there is a dominant colour, not found in the model, which is often called *the tone of such a picture, and the tone of such a painter*, if he uses it habitually.

307. We may form a very just idea of these pictures, by supposing the artist to have painted them while looking at his model through a glass of precisely the colour, to enable him to see the tint which predominates in his imitation. We may mention as an example, of this kind of imitation, a landscape painted from its reflection in a black mirror, the effect of which is very soft and harmonious. Thus we speak of brilliant or warm, cold or dull colouring.

Of Colouring in respect to the Harmony of the Colours of the various objects composing the Picture.

308. The colouring of the picture may be *true or absolute,* and yet not agreeable in effect because the colours of the objects are not harmonious. On the contrary, a picture may please by the harmony in the local colours of each object, and by that of the colours of objects contiguous to each other, and yet may offend in its gradation of lights and shades, and by the *fidelity* of its colours. In a word, it offends by *true or absolute* colouring, while a picture in flat tints, the colours of which are perfectly assorted for the eye, although not those which belong to the objects imitated, produces, with regard to general harmony of colours, an extremely agreeable effect.

309. The general conclusion resulting from the analysis just made of the word colouring, is, that the epithet *colourist* may be applied to painters endowed, in very different degrees, with the faculty of imitating coloured objects by means of painting.

310. They who know the difficulties of *chiaro-'scuro* and drawing, may give the name of colourists to painters remarkable for the skill with which they bring out objects placed upon the different planes of their pictures, by means of correct drawing and a skilful gradation of light and shade, even when their pictures do not exactly produce every modification of coloured light, and have not this harmony of different colours properly distributed to complete the effects of perfect colouring.

311. Persons unaccustomed to judge of painting, or *chiaro-'scuro,* are generally inclined to refuse the

title of colourist to such painters, while they unhesitatingly accord it to others who reproduce the modifications of coloured light, and who tastefully distribute the different colours of their pictures. Besides, the eye is so powerfully influenced by colour, that frequently those who are strangers to painting can only conceive a colourist to be skilful whose tints are vivid, although his works may evince a want of observation.

312. We see by this how judgments will differ according to the importance respectively attached to one quality of colouring rather than to another.

313. For a painter to be a perfect colourist, he must not only imitate the model by reproducing the image faithfully, with respect to the variously coloured light, but also with regard to harmony of tints in the local colours, and in the colours of the different objects imitated. And although there are colours inherent to the model, which the painter cannot change without being unfaithful to nature, yet, in every composition, there are also colours at his disposal which must be chosen so as to harmonize with the rest. We shall return to this subject in the next chapter.

314. It is thus evident, that when a change in the colours of a picture has been effected by time, it is impossible to decide whether the artist who painted it should be called a *perfect* colourist (310). But if we refer to what I have said of the painter who has correctly seized all the modifications of light adapted to bring out the distances and relief of objects, who has truly represented the modifications of coloured light, but which are not those of the model (312), we may very easily conceive how, at the present day, after the lapse

of centuries, we may apply the name of *colourist* to Albano, Titian, Rubens, and others. In fact, the pictures of these great masters now present to us gradations, more or less perfect, of light and shade, and such harmonies of colours, that it is impossible to mistake or not to admire them; and the idea that many pictures, not more than twenty or five-and-twenty years old, painted by artists of undoubted ability, have failed in colour more than the preceding, also increases our admiration of the latter.

CHAPTER II.

Utility of the Law of Simultaneous Contrast of Colours in the Art of Colouring.

315. As to the advantages the painter will find in it when it is required,—

1. To perceive and to imitate promptly and surely the modifications of the light on the model.
2. To harmonize those colours of a composition which are essentially inherent to the nature of the objects to be produced.

316. We learn by the law of *simultaneous contrast of colours,* that when we regard attentively two coloured objects at the same time, neither of them appears of the colour peculiar to it; that is to say, such as it would appear if viewed separately, but of a tint resulting from the peculiar colour and the complementary of the colour of the other object. On the other hand, if the colours of the objects be not of the same tone, the

lightest tone will be lowered, and the darkest tone will be heightened.

317. The first conclusion from this is, that the painter will rapidly appreciate in his model the colour peculiar to each part, and the modifications of tone and of colour which they receive from contiguous colours. He will also perceive and be prepared to imitate modifications in them, which, if they had not always escaped him because of their feeble intensity, might have been disregarded, because the eye is peculiarly susceptible of fatigue when it seeks to disentangle modifications, the cause of which is unknown, and which are not very prominent.

318. Let us now return to *mixed contrast* (77 *et seq.*), in order to make it evident that the painter is liable to see the colours of his model inaccurately. As the eye, after observing one colour for a certain time, has acquired a tendency to see its complementary, and as this tendency is of some duration, it follows, not only that the eyes of the painter thus affected cannot see correctly the colour which he had for some time looked at, but also whatever colour he sees while this modifying influence lasts. So that, conformably to what we know of mixed contrast, he will see,—not the colour which is before him,—but the result of this colour, and of the complementary of that seen previously. It must be remarked, that besides the want of clearness of view which will arise, in most cases, from the want of exact coincidence of the second image with the first—for example, when the eye has seen a sheet of green paper A (Plate III., fig. 4), in the first place, and, in the second place, a sheet of blue paper, B, of the same dimensions, but placed differently, this second image, not being coincident in all its surface

with the first, A, as represented in the figure, the eye will see the sheet B violet only in the part where the two images coincide. Consequently, this defect of perfect coincidence of images will affect the outline of the second image, as well as the colour which it really possesses.

319. We can establish three conditions in the appearance of the same object relatively to the state of the eye; in the first, the organ simply perceives the image of the object without taking into account the distribution of colours, light, and shade; in the second, the spectator, seeking to understand this distribution, observes it attentively, when the object presents to him all the phenomena of simultaneous contrast of tone and colour that it is capable of exciting in him. In the third case, the organ, from the prolonged impression of the colours, possesses in the highest degree a tendency to see the complementary of these colours; these different states of the organ being continuous.

I have no doubt that the dull colouring with which many artists of merit have been reproached is partly due to this cause, as I shall show more minutely hereafter.

Utility of this Law to facilitate the prompt Imitation of Modifications of Light on the Model.

320. The painter, knowing that the impression of one colour beside another is the result of the mixture of the first with the complementary of the second, has only to estimate mentally the intensity of the influence of this complementary, to reproduce faithfully in his imitation the complex effect which he has before his eyes.

321. A painter wishing to imitate a white stuff with

two contiguous borders, one red, the other blue, perceives each of them changed by the influence of their reciprocal contrast; thus the red becomes more and more orange, in proportion as it approaches the blue, as this latter becomes more and more green as it approaches the red. The painter, therefore, making the borders of a single red and a single blue, reduced in some parts by white or by shade, will reproduce the effects he wishes to imitate. Whenever it is found that the painting is not sufficiently marked, he is sure of what he must add without departing from the truth, farther than by exaggerating a little (305).

2. A grey pattern drawn upon a yellow ground: the ground may be of paper, silk, cotton or wool; according to its contrast, the design will appear of a lilac or a violet colour (66).

The painter who would imitate this object, can reproduce it faithfully with grey. But if a painter, ignorant of the reciprocal influence of blue and red, convinced that he must represent what he sees, adds green to his blue, and orange to his red; as in the second example, he will trace a pattern more or less violet upon the yellow ground. Now, supposing that the painter had perfectly seized the modifications of the model, and, subsequently, had retouched his copy sufficiently to produce a perfectly faithful effect, it is evident it would have been perfect only after a number of trials, since he must have effaced what was first done.

3. I cite a third example of the influence of contrast, not relating to colours, like the two preceding, but to the different tones of the same colour, contiguous to each other.

Suppose several bands in juxtaposition, 1, 2, 3, 4,

(Plate 1, fig. 3), of different tones in flat tints of the same scale, to form part of an object: to imitate it perfectly, it is evident that it must be painted in flat tints; but this object will appear to the eye a channeled surface, the lines where the two bands touch will appear like a relief by the effect of contrast of tone (9—11); therefore, if the painter is ignorant of this, he will reproduce, not an absolute copy of the model, but an exaggerated one. I the more willingly cite this example, because it gave me an opportunity of enabling a most skilful paper-stainer to appreciate the utility of the law of simultaneous contrast. In going with him over his factory, he showed me a chimney-board representing a child whose figure stood out from a ground formed of two circular bands in grey flat tints, 1 and 2 (Plate I., fig. 7); the first was higher than the second; the phenomenon of contrast of tone was manifested at the borders, *a a*, of the two bands, so that the part of the band 2, contiguous to the band 1, was darker than the rest, as the part of the band 1, contiguous to 2, was lighter than the rest, conformably to what has been stated above (11). This effect, not being what the skilful artist wished to obtain, he inquired of me how it was to be avoided. I replied, that the grey of the band 2 must be reduced with white, in proportion as it approached the border *a a*; and, on the contrary, the grey of the band 1 must be strengthened with black, in proper gradations, beginning at the same border. And I proved to him, *that to imitate the model faithfully, we must copy it differently from what we see it.*

322. From the above we educe the six following principles:—

1. Put a colour upon a canvas, it not only colours that part of the canvas to which the pencil has been applied, but it also colours the surrounding space with the complementary of that colour.

Thus, a red circle is surrounded with a green areola, becoming weaker as it extends from the circle:—

A green circle is surrounded with a red areola.

An orange	„	„	blue „
A blue	„	„	orange „
A yellow	„	„	violet „
A violet	„	„	yellow „

(See Plates 3, 4, 5.)

2. White placed beside a colour heightens its tone; it is as if we took away from the colour the white light which enfeebled its intensity (44—52).

3. Black placed beside a colour weakens, and in some cases impoverishes, its tone, as upon certain yellows (55). It is, in fact, adding to black the complementary of the contiguous colour.

4. Put grey beside a colour, the latter is rendered more brilliant, and at the same time it tints this grey with its complementary (63).

323. From this principle it results that in many cases where grey is near to a pure colour in the model, the painter, if he wishes to imitate this grey which appears to him tinted with the complementary of the pure colour, need not use a coloured grey, as the effect will be produced in the imitation by the juxtaposition of the colour with the grey contiguous to it.

Besides, the importance of this principle cannot be doubted, when we consider that all the modifications which a monochronous object presents (excepting those

which result from the reflections of coloured lights emanating from neighbouring objects,) arise from the different relations of position between the parts of the object and the eye of the spectator; so that it is strictly true to say that, to reproduce by painting all these modifications, it suffices to have a colour exactly identical to that of the model, with black and white. In fact, with white we can reproduce all the modifications due to the weakening of the colour by light, and with black, those which are due to the height of its tone. If the colour of the model in certain parts gives rise to the manifestation of its complementary, because these parts do not return to the eye enough colour and white light to neutralize this manifestation, the modification may be imitated by the employment of a normal-grey tone, properly surrounded with the colour of the object.

It is necessary, in many cases, to employ with the colour of the object the colours which are near it; that is to say, the hues of the colour. For example; in imitating a rose, we can employ red shaded with a little yellow, and a little blue, or, in other terms, shaded with orange and violet; but the green shadows which we perceive in certain parts arise from the juxtaposition of red and normal grey.

5. To put a dark colour near a different, but lighter colour, is to heighten the tone of the first, and to lower that of the second, independently of the modification resulting from the mixture of the complementaries. An important consequence of this principle is, that the first effect may neutralize the second, or even oppose it. For example; a light blue placed beside a yellow tinges it orange, and consequently heightens its tone; while

there are some blues, so dark relatively to the yellow, that they weaken it so much as not only to hide the orange tint, but even to cause sensitive eyes to feel that the yellow is rather green than orange. A very natural result, if we consider that the paler the yellow, the greener it appears.

6. Put beside each other two flat tints of different tones of the same colour, chiaro-'scuro is produced, because, in setting out from the line of juxtaposition, the tint of the band of the highest tone is insensibly enfeebled, while, setting out from the same line, the tint of the band of the lowest tone becomes heightened; thus there is a true gradation of light.

The same gradation takes place in all the juxtapositions of colours distinctly separated.

I believe that attention to these principles, and especially a perfect knowledge of the consequences of the last three, exercises a very happy influence upon the art of painting, giving to the artist such a knowledge of colours as he cannot possess before the law of their simultaneous contrast and its consequences have been developed.

Among the details which the painter endeavours to render, there are many which, due to contrast, either of colour or of tone, must be produced spontaneously. I presume that the Greek painters, whose palette was composed only of black, white, red, yellow, and blue, and who executed so many pictures which their contemporaries have spoken of with intense admiration, painted conformably to the simple method of which I speak; *devoting themselves to great effects, many small ones resulted from them.*

Utility of the Law in order to Harmonize those Colours of a Composition which are Inherent to the Nature of the Object represented.

324. In all, or nearly all, compositions of painting, we must distinguish the colours which the painter is under the necessity of using, and those which he may choose, because, unlike the former, they are not inherent to the model (313). For example, in painting a human figure, the colour of the flesh, the eyes, and the hair, are fixed by the model; but the painter has a choice of draperies, ornaments, background, &c. In an historical picture, the flesh colours are, in the majority of the figures, at the choice of the painter, as are also the draperies and all the accessories, which can be placed and imagined according to his judgment.

In a landscape, the colours are determined by the subject, yet not so arbitrarily but that we can substitute for the true colour that of a neighbouring scale; the artist may choose the colour of the sky, imagine numerous accidental effects, introduce into his composition animals, draped-figures, carriages, &c., of which the form and colour may be so selected as to produce the best possible effect with the actual objects of the scene.

325. A painter may also choose a dominant colour which produces, on every object in his composition, the same effect as if they were illuminated by a light of the same colour, or as if they were seen through a coloured glass (259).

326. Athough the law of contrast affords different methods of imparting value to a colour, genius alone can indicate the mode in which this idea should be realized in a painting.

327. Whenever the artist would attract the eye by colours, doubtless the principle of *harmony of contrast* must be his guide. The law of *simultaneous contrast* indicates the means of giving value to the pure colours by each other; means which, although spoken of, are but little known, as may be commonly seen in portraits of vivid colours, badly assorted; and in those numerous small compositions in tints broken with grey, where we look in vain for a pure tone; which, however, from the objects represented in them, are eminently adapted to receive all vivid colours.

328. The contrast of the most opposite colours is as agreeable as possible, when they are of the same tone. But if crudity or too great intensity of colours is feared, we must have recourse to the light tones of their respective scales.

329. When the painter breaks tones with grey, and wishes to avoid monotony, or when on the planes which are more remote, yet not so remote as to render their differences of colour inappreciable, he wishes every part to be as distinct as possible, he must have recourse to the principle of *harmony of contrast*, and mix his colours with grey.

330. This method of bringing out a colour by contrast, in using either light tones complementary or more or less opposed, or broken tones more or less grey, and of tints complementary to each other; or, in employing a broken tone, of a tint complementary to a more or less pure contiguous colour, ought especially to fix the attention of portrait painters. A portrait will have a very poor effect when neither the colour of the dress nor of the background have been well chosen.

331. The portrait-painter must endeavour to find the

predominating colour in the complexion he has to paint; and this found and faithfully reproduced, he has to seek whatever accessories at his disposal will give value to it. It is a very common error to suppose that the complexion in women, to be beautiful, must consist only of red and white: if this opinion be true for most of the women of our temperate climate, it is certain that in warmer regions there are brown, bronzed, or even copper complexions endued with a brilliancy, I may say beauty, appreciated only by those who, in pronouncing upon a new object, lay aside habitual expressions, which (albeit unconsciously to most men), exercise so powerful an influence upon their judgment of objects seen for the first time.

See the section in which I have treated of *the application of the law of contrast to dress.* (Div. V.)

332. In order to make the best use of colours without being under the necessity of multiplying them, as, for example, in draperies of a single colour, recourse may be had to the coloured rays emanating from neighbouring bodies, whether visible to the spectator or out of sight. For example, a green or yellow light falling upon part of a blue drapery renders it green, and by contrast heightens the blue-violet tone of the rest; a golden yellow light falling on part of a purple drapery imparts to it a golden tint, which makes the purple of the rest come out, &c.

333. The principle of harmony of contrast then procures for the painter in chiaro-'scuro the means of realising, with respect to brilliancy of colours and distinction of parts, such effects as are produced in paintings of flat tints.

334. Having treated of the utility of the law of

simultaneous contrast in the intelligent use of pure opposite colours, and of colours broken by grey similarly opposed when it is required to multiply pure and varied colours, it now remains for me to treat of those cases in which the painter, desiring less diversity in the object, less variety in the colours, employs sparingly the *harmony of contrast,* preferring the *harmony of scale* and the *harmony of hues.*

335. The greater the variety of colours and accessories in a composition, the more the eyes of the spectator are distracted, and the more difficulty is experienced in fixing attention. If then, this condition of diversity of colours and accessories is obligatory on the artist, the more obstacles there are to surmount in drawing and fixing the attention of the spectator upon the physiognomy of the figures, whether they represent the actors in a single scene, or whether they are simply portraits. In the latter case, if the model has such an ordinary physiognomy, as recommends itself neither by its expression nor its beauty, and still more, if he must conceal or dissemble a natural defect, all that is accessory to this physiognomy, all the resources of contrasted colours, well assorted, should come to his aid.

336. But if, fervently inspired, he appreciates the purity of expression, the nobility and loftiness of character pertaining to his model; or even if a physiognomy, to most eyes common-place, strikes him by such an expression as he judges to belong only to men animated by noble ideas, it is to such a model that he will address himself and fix his chief attention; so that in giving it life upon his canvas, no one can mistake either the resemblance, or the sentiment which directed his pencil.

Everything being accessory to the physiognomy, the draperies will be of black or of sombre colours; and if ornaments relieve them, they will be simple, and always in keeping with the subject.

337. When, in this point of view, we examine the masterpieces of Vandyke, and trace the beauty of their effect to the simplicity of the means which produce it,—when we consider the elegance of their attitudes, which always appear natural, the taste which presided over the selection of all the accessories, we are struck with admiration of the genius of the artist, who has not had recourse to those means, so much abused at the present day, of attracting attention, either by giving to the most vulgar person an heroic attitude, to the most common-place physiognomy pretension to profound thought, or by seeking extraordinary effects of light, such as filling the figure with a strong light, while the rest of the composition is in shade.

338. These reflections indicate the course which an historical painter must take, when he would particularly fix the attention upon the physiognomy of the persons in a remarkable scene. The more he employs allied scales, the more care he must take to select such as do not lose too much by their mutual juxtaposition.

339. There is another important direction to give, which is to avoid as much as possible the same kind of images on different objects; thus figures clothed in draperies with large flower patterns, in a room where the carpet and porcelain vases repeat the same images, are never free from objection, for it is troublesome to the eye to distinguish those parts of the picture which the similarity of ornaments tends to confound.

Upon the same principle, the painter must generally avoid placing beside the faithful copy of a model the copy of an imitation which repeats this model. For example, when he paints a vase of flowers, the artist produces most effect, other things being equal, in painting a vase of grey or white porcelain, instead of a vase upon which a profusion of similar objects are its ornaments.

340. When it is required that a certain colour shall predominate in a composition, or to speak more correctly, when the scene is illuminated by a coloured light, shed over every object, we must not only take simultaneous contrast into consideration, but also the modification which results from the mixture of colours (172), comprising the recomposition of white light by means of a proper proportion of the differently coloured elementary rays.

341. We must here attentively study the article which treats of the principal cases of the modifications of light resulting from coloured rays falling upon bodies of various colours (261, *et seq.*), when, although the coloured light chosen imparts value to certain colours of the objects upon which it falls, it also impoverishes and even neutralizes others. Consequently, in employing any predominant colour, we must renounce the advantages of others, or the effect produced will be false. For example: if orange colour predominates, for the colouring to be true it must necessarily follow—

1. That the purples must be more or less red.
2. That the reds must be more or less scarlet.
3. That the scarlets must be more or less yellow.
4. That the orange must be more intense, more vivid.

5. That the yellows must be more or less intense, and orange.
6. That the greens lose their blue, and consequently become yellower.
7. That the light blues become more or less light grey.
8. That the deep indigo becomes more or less maroon.
9. That the violets lose some of their blue.

Thus we see that orange light heightens all the colours which contain red and yellow, while, neutralizing a portion of blue in proportion to its intensity, it destroys wholly or partially this colour in the body which it illuminates, and consequently disturbs the greens and the violets.

342. With reference to the true imitation of colouring, it appears to me that painters of interiors, have, other things being equal, more skill than historical painters in faithfully reproducing the modifications of light. Historical painters, attaching more importance to the attitudes and physiognomy of their figures than to the other parts of their composition, attend less to small details, the faithful imitation of which is the essential merit of the painter of interiors. Besides, the historical painter is never in a position to see the whole of the scene he would represent, while the painter of interiors, having constantly his model before him, sees it completely, as he imitates it upon the canvas. Hence, therefore, in every small composition the colours, as well as the objects represented, must be distributed with a kind of symmetry, so as to avoid being what I can best express by the term *spotty*. In fact, for want of a good distribution of objects, the canvas will not be filled in some parts, or, if it is, there will be, in many places, evident

confusion ; so also if the colours be not properly distributed, the picture will be spotty, because they are too far isolated from the others. (See 249—251.)

343. I believe that those painters who will study the mixed and simultaneous contrasts of colours, in order to employ rationally the coloured elements of their palette, will perfect themselves in *absolute colouring* as by studying the principles of geometry they perfect themselves in linear perspective. I have no doubt but that the difficulty encountered by painters ignorant of the law of contrast, of faithfully imitating their model, has been with many the cause of a colouring dull and inferior to that of artists, who, less careful than they in the fidelity of imitation, or not so well organized for seizing all the modifications of light, have worked more by their first impressions, or, in other words, seeing the model more rapidly, their eyes have not had time to become fatigued ; and thus, content with the imitation which they have made, they have not returned to their work too often to modify, to efface, and afterwards to reproduce it upon a canvas soiled by the colours first put on. There are, indeed, many painters, to whom the maxim, "Let well alone," is peculiarly applicable.

Second Division.

Imitation of Coloured Objects by Materials of a Definite Size, as Threads, &c.

344. The tapestries of Gobelins and of Beauvais, and also the carpets of Savonnerie, and certain very elaborate mosaics, may all be considered as works which resemble the method of painting in *chiaro-'scuro ;* while the windows of Gothic churches correspond more or less exactly

to painting in *flat-tints;* so also with tapestries for furniture and carpets, which, instead of being fabricated with scales of at least sixteen or eighteen tones, as they are in the royal manufactories, are composed with scales consisting of three or four tones only, and, far from imitating the effects of *chiaro-'scuro*, the coloured objects produced present to the eye only small monochromous bands of a single tone.

345. There are also some works whose coloured designs are upon a kind of mixed system, being the result of the juxtaposition of monochromous single tinted parts, of a visible size, but in which the effects of *chiaro-'scuro* are sought by using gradations of scale or a mixture of hues; such are ordinary mosaics, carpets, embroidered tapestries, &c.

346. In the patterns of tapestries and carpets, when the principal effects to be aimed at have been determined, it may be seen what points of ordinary painting may be sacrificed to obtain them, and what must be done for perfecting the *special portion of their imitation.* Beginning with the physical condition of the coloured elements the weaver employs, and the texture of the tapestry, we see the necessity of representing in this kind of work only large, well-defined objects, and especially such as are remarkable for the brilliancy of their colours. The patterns for hangings must recommend themselves more by the opposition of their colours than by the minute finish of their details. To pretend to rival painting in these manufactures is to establish a confusion most detrimental to the progress of arts, absolutely distinct from painting, both in their purpose and their means of execution.

347. The principles truly essential to these arts of

imitation being once deduced from the peculiarities of each, it becomes easy to point out by what efforts we may hope to obtain true perfection.

CHAPTER I.

ON THE ELEMENTS OF GOBELINS TAPESTRY.

348. To make mixtures of coloured threads intelligently, we must be guided by the three following rules: —The first two resulting directly from observation of facts; the third being the natural deduction from the facts comprised in the two former.

RULE I.—THE BINARY MIXTURE OF PRIMARY COLOURS.

When we unite Red with Yellow, Red with Blue, Yellow with Blue, the threads must not reflect a perceptible quantity of the third primary colour, if we would have Orange, Violet, and Green as brilliant as it is possible, by this method, to obtain.

EXAMPLE A.—*Red and Yellow.*

Plate 11.

3	Red	threads with	1	Yellow	thread,
2	„	„	1	„	„
1	„	„	1	„	„
3	Yellow	„	1	Red	„
2	„	„	1	„	„

yield mixtures which appear to the eye in proportion to the two colours mixed. There is no appearance of grey in any of these mixtures, when we employ a red more inclining to orange than to crimson, and a yellow more inclining to orange than to green.

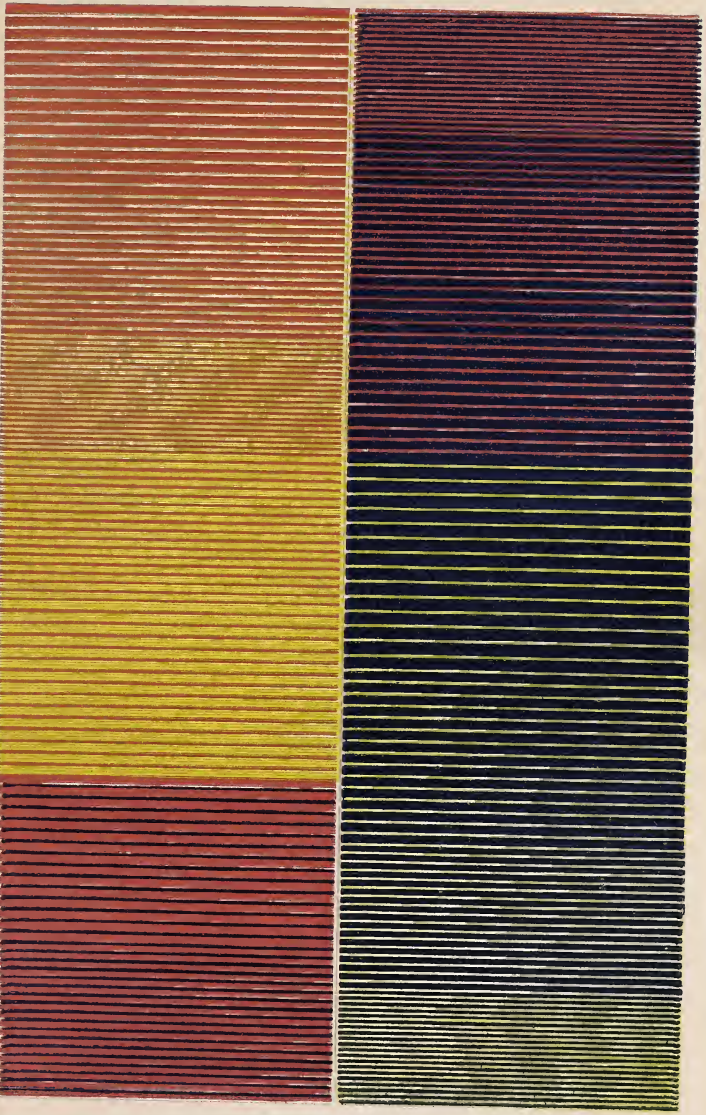


PLATE XI.

B.—*Red and Blue.*

3	Red	threads	with 1	Blue	thread,
2	„	„	1	„	„
1	„	„	1	„	„
3	Blue	„	1	Red	„
2	„	„	1	„	„

yield mixtures which appear to the eye in proportion to the two colours mixed. If we use a red and a blue inclining to violet, the mixture will contain no grey.

C.—*Yellow and Blue.*

4	Blue	threads	with 1	Yellow	thread,
3	„	„	1	„	„
2	„	„	1	„	„
1	„	„	1	„	„

give mixtures which appear to the eye in the proportions of the two colours mixed. If we use yellow and a blue inclining to green more than to red, the mixture will contain little or no grey.

Experiment on all the preceding mixtures demonstrates the rule above; or rather, this rule is but the expression of a generalization of facts.

RULE II.—THE MIXTURE OF COMPLEMENTARY COLOURS.

349. *When we mix Red with Green, Orange with Blue, Yellow with Violet, the colours are more or less completely neutralized, according as they are more or less perfectly complementary to each other, and as they are mixed in proper proportions. The result is a grey, the tone of which is generally higher than that of the colours mixed, if the latter are of a suitably high tone.*

EXAMPLES.—*Red and Green.*

Plate 12.

3 Red threads with 1 Green thread give a dull Red.

2 Red threads with 1 Green thread give a duller and a deeper Red.

1 Red thread with 1 Green thread give a Reddish-grey.

The tone a little higher than the preceding.

3 Green threads with 1 Red thread give a Green Grey, the tone higher than the Green or the Red.

2 Green threads with 1 Red thread give a Grey, less Green, and of a higher tone than the two colours.

In repeating the same mixtures with higher tones of the same scales of Green and Red, the tone of the mixture of 2 Green with 1 Red is higher relatively to that of the colours mixed, than it is in the mixtures above.

1 Red thread and 1 Yellowish-green thread give a Carmelite-brown or an Orange-grey, the tone of which is equal to that of the colours mixed.

1 Red thread and 1 Bluish-green thread give a copper-coloured mixture or catechu-brown of a higher tone than that of the colours mixed.

Hence we may conclude that red and green threads, properly assorted, and in suitable proportions, yield *Grey*.

Orange and Blue.

3 Orange	„	1 Blue	„	a dull Orange.
2 Orange	„	1	„ „	a duller Orange.
1 Orange	„	1	„ „	Chocolate-grey.
3 Blue	„	1 Orange	„	Violet-grey.
2 Blue	„	1 Orange	„	Violet-grey.

Redder than the preceding.



PLATE XII. *Page* 105.

The results are the same with deeper tones than the preceding, except that the corresponding mixtures are browner.

3 orange threads with 3 blue threads present a remarkable phenomenon, according to the intensity of the light and the position from which it is observed. The tapestry being placed in a vertical plane before the incident light when the warp is horizontal, we perceive *blue* and *orange* stripes; but if the warp is vertical, we may then see the upper part of each blue stripe *violet*, and its under part, as well as the upper part of each orange stripe *green*, while the rest of each of the latter will appear *red*, bordered on the lower part with *yellow*. We may also see the upper part of each blue stripe, *violet*, and its under part, as well as the upper part of each orange stripe, *green*, and the rest of each of these stripes *red*, bordered on the lower part with green, and in the upper part with yellow. We say that they may be seen in this manner, because if the light were strong enough for distinct vision, we should not see the horizontal blue and orange stripes.

Yellow and Violet.

3 Yellow threads with 1 Violet give a Greyish-yellow.
2 „ „ 1 Violet „ Yellow-grey.
1 „ „ 1 Violet „ Grey, much nearer *normal grey* than the preceding.

3 Violet threads and 1 Yellow give a Greyish-violet.
2 „ „ 1 Yellow „ dull Violet, greyer than the preceding.

It is remarkable that in the mixture of a yellow with a violet thread, seen from a greater distance than that

at which they appear neutralized, the yellow is so much weakened in proportion to the violet, that the mixture appears of a dull violet.

Yellow and blue afford an analogous result.

RULE III.—THE MIXTURE OF THE THREE PRIMARY COLOURS IN SUCH PROPORTIONS THAT THEY DO NOT BECOME NEUTRALIZED, BECAUSE ONE OR THE OTHER OF THEM IS IN EXCESS.

350. *When Blue, Red, and Yellow are combined in such proportions that they do not neutralize each other, the result is a colour much greyer or more broken than if the proportion of complementary colour were more equal.*

As Red mixed with a Greenish-yellow gives a *Carmelite* mixture, I shall add the following :—

1. *Crimson-red and greenish-yellow* give mixtures so much duller as these colours more nearly neutralize each other. A mixture of one crimson-red with one greenish-yellow thread produces a brick or copper-orange, the tone of which is higher than that of the colours mixed.

2. *Scarlet-red and greenish-blue* give mixtures which are without vigour or purity, relatively to the corresponding mixtures made with crimson-red and violet-blue.

3. Red and blue-grey give violet mixtures, which are not so dull as the preceding, because the colours contain no yellow.

4. The red of the mixture 3, worked with a green-grey, gives mixtures much duller than the preceding, as might have been expected, on account of the yellow contained in the green-grey.

5. Orange and blue-violet give very dull mixtures.

6. Orange and red-violet give dull mixtures, but redder or less blue than the preceding.

ON THE PRINCIPLE OF CONTRAST IN CONNEXION WITH THE PRODUCTION OF TAPESTRY.

351. The tapestry-weaver should therefore thoroughly understand the effects of contrast, to know the influence which the part of the copy he proposes to imitate receives from the colours surrounding it, and so judge what coloured threads to choose. The following examples will explain better than the most profound reasoning the necessity for the tapestry-worker to possess a knowledge of the law of contrast.

First Example.

352. If there be two coloured stripes in a picture, one red the other blue, touching each other, the phenomenon of contrast between two contiguous colours would have arisen, had not the painter sustained the red by blue, and the blue stripe by making it red or violet next to the red stripe (320).

353. Suppose a weaver wishing to imitate these two stripes, but ignorant of the law of contrast of colours, after choosing the wools or silks, he is sure to make two stripes, which will produce the phenomenon of contrast; for he will select his wools or silks of only one blue or one red, to imitate two stripes of different colours, each of which appears homogeneous throughout, but which the painter has only succeeded in making so by neutralizing the phenomenon of contrast, which would undoubtedly have resulted had each been painted of a uniform colour.

354. Suppose the painter has painted the stripes with

uniform colours, then contrast will arise, so that the red contiguous to the blue will appear orange, and the blue contiguous to the red will appear greenish.

If the weaver be ignorant of the law of contrast, in attempting to imitate his model he will be sure to mix yellow or orange with his red, and yellow or green with his blue, in those parts of the stripes which come in contact. Hence the contrast will be more exaggerated than if he had worked the two stripes with homogeneous colours.

355. Suppose a weaver has to copy the series of ten grey stripes in flat tints (fig. 3, Plate 1) described (11), it is evident that if he is ignorant of such effects he will exaggerate it in the imitation; for instead of working ten tints of the same scale so as to produce ten bands in flat tints, he will make ten bands, each graduated conformably to what he sees; he will probably also have recourse to lighter and darker tones than those which correspond exactly to the model, and thus he will require a greater number of tones than would have been necessary had he been aware of contrast, rendering the copy an exaggeration of the model.

When we attentively observe the rosy flesh-tints of many pictures, we perceive in the shadows a more or less apparent green tint, resulting from the contrast of rose with grey. (I presume that the painter has made his shadows without using green, and that he has not corrected the effect of contrast by using red.) Now a weaver, ignorant of the effect of rose upon grey, in imitating the shaded part will have recourse to a green-grey, which will exaggerate an effect that would have been produced naturally by employing a scale of pure, not of greenish grey.

QUALITIES WHICH PATTERNS FOR GOBELINS TAPESTRY MUST POSSESS.

356. To determine the qualities which model pictures for tapestry must possess, we must decide what are specific qualities peculiar to this kind of imitation.

The weaver imitates objects with coloured threads of a certain diameter. These threads are applied round the threads of the warp. Their surface is not uniform but furrowed, those which are parallel to the threads of the warp being lower than those which are perpendicular to it; the effect of these furrows being such as would be produced upon a picture, by a series of dark parallel lines, cut at right angles by another series of finer parallel lines, less dark than the preceding.

357. There are these differences then between tapestry and painting :—

1. Tapestry never presents those blended colours which the painter obtains so easily by indefinitely mixing or dividing his pigments.

2. The symmetry and uniformity of the furrows of tapestry prevent the lights being as vivid, and the shadows as vigorous, as in a painting; for though the furrows obscure the lights, the salient parts of the threads which are in the shades, have the ill effect of enfeebling the latter by the light they reflect.

3. The lines surrounding the different objects in a painting, although straight or curved in every direction, may be of extreme fineness without ceasing to be perfectly distinct, while the threads of the weft and the

warp, always crossing at right angles, interfere with such a result whenever the lines of the pattern do not exactly coincide with these threads.

4. The painter has other resources, which are denied to the weaver, for increasing the brilliancy of the lights and the vigour of the shadows. For instance: he opposes opaque body-colours to glaring colours, he modifies an object of a single colour by varying the thickness of the layer of paint which he places on the canvas; and within certain limits he can produce modifications, by changing the direction of the strokes of his pencil.

358. Hence, to raise the effects of tapestry as nearly as possible to those of painting, it is requisite :—

1. That the objects be represented of such a size that the position of the spectator does not permit of his distinguishing either the coloured elements from each other, or the furrows which separate them; so that threads of two mixed scales (377), and the hatchings of different scales, more or less distant, interwoven together (378), may be mingled into a homogeneous colour, and that the cavities and salient parts may appear as a uniform surface.

2. That the colours be as vivid and strongly contrasted as possible, so that the lines which surround the different objects be more distinct, and the lights and shadows be as different as possible.

359. Thus patterns for tapestry must not only recommend themselves by correct outline and elegant forms, but must also represent larger objects: figures draped rather than nude, vestments decorated with ornaments,

rather than simple and uniform. Consequently, every thing allied to miniature, by minuteness or by finish in details, is foreign to its special object.

360. The elements of Beauvais tapestry for furniture are essentially the same as those of Gobelins tapestry; but with this difference, that the light and the middle tones are of silk, while in the Gobelins tapestry these tones are almost always of wool. The scales of Beauvais are less varied in colour than those of the Gobelins, and their tones are less numerous. But the working of the threads is the same in both kinds of tapestry; so that as to the employment of coloured threads, depending in like manner on the knowledge and observance of the principles of mixture and contrast of colours, I need not add to what I have already said on this subject in the preceding section.

361. The furrows caused by the weft and the warp have not the inconvenience they present in the Gobelins tapestry. In fact, the regular grain of the tapestry for furniture is so far from producing a bad effect in the image represented on it, that we are obliged to give the appearance of this grain to many paper-hangings by means of parallel lines cutting it, or by points symmetrically placed.

COLOURED GLASS WINDOWS IN LARGE GOTHIC CHURCHES.

362. I am about to examine, according to the preceding views, the coloured glass windows which concur so powerfully with architecture, in giving to vast gothic churches that harmony which we cannot fail to recognise whenever we enter them. These structures rank with

those works of art which are most impressive by their size, the subordination of their various parts, and by their complete fitness for the purposes to which they are applied. The stained glass of gothic churches has always a most appropriate effect, intercepting the white light, which, by giving too vivid a glare, is less conducive to meditation than the coloured light which this glass transmits. We shall find its splendid effect to arise, not only from the contrast of colours, but also from the contrast of its transparency with the opacity of the surrounding walls, and of the lead which binds its parts together. The impression produced on the eye by this twofold cause becomes more vivid the more frequently it is repeated and the longer it is sustained, when yellow, blue, violet, orange, red, and green stained glass appears like most precious jewels.

363. The upright windows usually represent, within a border or a ground analogous to the rose windows, the figure of a saint in harmony with those which stand in relief about the portals of the edifice; and to be fully appreciated they must be judged of as *parts of a whole,* and not as a Greek statue which is intended to be seen isolated on all sides.

The glass is of two kinds, the one painted on its surface by pigments afterwards vitrified (glass painting); the other, melted with the material that colours it (glass staining); the first is generally used in the composition of the nude parts of the human figure, and the second in that of the drapery. All the pieces of glass are united by strips of lead. What has struck me as being most effective in windows with human figures, is the exact observance of the relations of size of the figures and of the intensity of the light which renders them

visible, with the distance at which the spectator is placed; a distance at which the strips of lead surrounding each piece of glass appear only as lines or as small black bands.

364. It is not necessary, for an effective whole, that the *painted glass*, when viewed closely, should exhibit fine hatchings, careful stippling, or blended tints; for, with the coloured stained glass for draperies, they should compose a system which compares with painting in flat tints, and certainly we cannot doubt that a painting on glass, executed entirely according to the system of *chiaro'scuro*, not to speak of the cost of its execution, will have the disadvantage of the finish in its details entirely disappearing at the distance at which it must be viewed as a whole.

365. *The first condition, which must be fulfilled by every work of art, is, that it be presented without confusion and as distinctly as possible.* Let us add that paintings on glass, executed on the method of *chiaro-'scuro*, cannot receive the borders and grounds of rose windows which have such fine effects of colour, as they have less brilliancy and transparency than the glass in which the colouring material has been incorporated; they are also less capable of resisting the injuries of time.

Variety of colours in these windows is so necessary to attain the best possible effect, that those which represent figures entirely nude, edifices, or large objects of a single colour, or slightly tinted, whatever may be the perfection of their execution with regard to finish or truth of imitation, will have an inferior effect to windows composed of pieces of varied colours suitably contrasted; but a bad effect results from the mixture of coloured glass with transparent colourless glass, when the latter

has a certain extent of surface in a window; yet a good effect is obtainable by mixing ground glass with coloured glass, and also of small pieces of colourless transparent glass, framed in lead, so that at the distance at which they must be viewed they produce the effect of a symmetrical juxtaposition of white parts with black parts.

366. I conclude that we must refer the causes of the beautiful effects of coloured glass of great churches—

1. To their presenting a very simple design, whose different well-defined parts may be seen without confusion at a great distance.
2. To their offering a union of coloured parts which are distributed with a kind of symmetry, but which are also vividly contrasted, not only among themselves, but also with the opaque parts which surround them.

367. Coloured windows appear to me to produce their utmost effect only in the vast edifices where the different-coloured rays reach the eye of the spectator on the floor of the church so much scattered that they impinge upon each other, whence results an harmonious mixture, not found in a small structure lighted by coloured windows. It is this intimate mixture of the coloured rays, transmitted into a vast edifice, which permits of tapestries placed on the ground floor. But when the lower walls have not colourless glass windows, it is evident that, if tapestries be placed too near coloured windows, the harmony of their colours must be lost, as when blue rays fall upon red draperies, yellow rays upon blue draperies, &c.

Thus, when coloured glass is to be put in a window, it is necessary to take into consideration, not only its

beauty, but also the effect which the coloured light it transmits will have upon the objects illuminated by it.

368. The coloured windows of a large church may be regarded as real, transparent tapestries, intended to transmit light, and to ally themselves harmoniously with the sculptures on the exterior, which destroy the monotony of the high walls of the edifice, and with the different monuments of the interior, among which tapestries must be taken into account.

369. My ideas on the employment of stained glass for windows may be summed up in the following terms :—

1. They produce their utmost effect only in the rose windows, bay windows, or pointed windows of large Gothic churches.
2. Only when they present the strongest harmonies of contrast, not of colourless transparent glass with the black produced by the opacity of the walls, iron bars, and strips of lead, but of this black with the intense tones of red, blue, orange, violet, and yellow.
3. Their designs must always be as simple as possible, and admit of the harmonies of contrast.
4. While admiring painted windows, of which a large number consist of paintings of undoubted merit, especially in regard to the difficulties overcome, I confess that it is a kind of painting which should not be much encouraged, because it never has the merit of a picture properly so called, it is more costly, and will produce less effect in a large church than a stained window of much lower price.

5. Windows of a pale grey ground, with light arabesques, have a very poor effect wherever they are placed.

See the relations of the law of contrast with the decoration of the interiors of churches.

Third Division.

Colour Printing.

ON CALICO PRINTING, AND PRINTING PAPER-HANGINGS.

370. I propose to examine only the optical, not the chemical, effects produced by patterns printed upon woven fabrics.

Printing on textile fabrics was for a long time limited, so to speak, to cotton cloths. It is only of late years that it has been extended to fabrics of silk and wool, for furniture and clothing. This branch of industry has now undergone an immense extension, fashion having accepted these products with extreme favour; but, whatever may be the importance of the subject, in a commercial point of view, I must treat it briefly. This book is not directed exclusively to that branch of inquiry, and as all the preceding part is intimately connected with it, I shall merely state some facts which show, that, in ignorance of the law of contrast, the manufacturers and printers of cotton, woollen, and silk stuffs are constantly exposed to error in judging the value of recipes or colours, or as to the true tint of the design applied upon grounds of a different colour.

FALSE JUDGMENT OF THE VALUE OF RECIPES FOR COLOURING COMPOSITIONS.

371. At a certain calico-printer's a recipe for printing green had always succeeded up to a certain period, when it began to give bad results. They were lost in conjectures upon the cause, when a person, who at the Gobelins had followed my researches on contrast, recognised that the green of which they complained, being printed on a ground of blue, inclined to yellow through the influence of orange, the complementary of the ground. She therefore advised that the proportion of blue in the colouring composition should be increased in order to correct the effect of contrast. The recipe, modified according to this suggestion, gave the beautiful green which they had obtained formerly.

372. Thus every recipe for colours to be applied upon a ground of another colour, must be modified conformably to the effect which the ground will produce. It is this great facility in correcting the ill effect of certain contrasts which explains why they so often succeed without being able to account for it. Here, notwithstanding their colour, the eye judges them to be colourless, or of the tint complementary to that of the ground. These appearances have been the subject of questions frequently addressed to me by the manufacturers of printed stuffs, and by drapers: they are due to the *law of simultaneous contrast of colours.* In fact, when the patterns appear white, the ground acts by contrast of tone (9); if they appear coloured (and this appearance generally succeeds to that where they appear white), the ground then acts by contrast of colour (13). The manufacturer of printed stuffs therefore will not seek to attri-

bute the cause of these phenomena to the chemical actions in his operations.

373. Ignorance of the law of contrast has, among drapers and manufacturers, been the subject of many disputes, which I have been happy to settle amicably, by demonstrating to the parties that they had no possible cause for litigation in the cases they submitted to me. I will relate some of these, to prevent similar disputes.

Certain drapers gave to a calico-printer some cloths of single colours, red, violet, and blue, upon which they wished black figures to be printed. They complained that upon the *red* cloths he had put *green* patterns; upon the *violet*, the figures appeared *greenish-yellow;* upon the *blue*, they were *orange-brown* or *copper*-coloured—instead of the *black* which had been ordered. To convince them that they had no ground for complaint, it sufficed to have recourse to the following proofs :—

1. I surrounded the patterns with white paper, so as to conceal the ground; the designs then appeared black.
2. I placed some cuttings of black cloth upon stuffs coloured red, violet, and blue; the cuttings appeared like the printed designs, *i. e.*, of the colour complementary to the ground, although the same cuttings, when placed upon a white ground, were of a beautiful black.

374. The modifications which black designs undergo upon different coloured grounds are the following :—

Plate 13.

Upon *Red* stuffs they appear *Dark Green.*

Upon *Orange* stuffs they appear of a *Bluish-black.*

Upon *Yellow* stuffs they appear *Black*, the violet tint

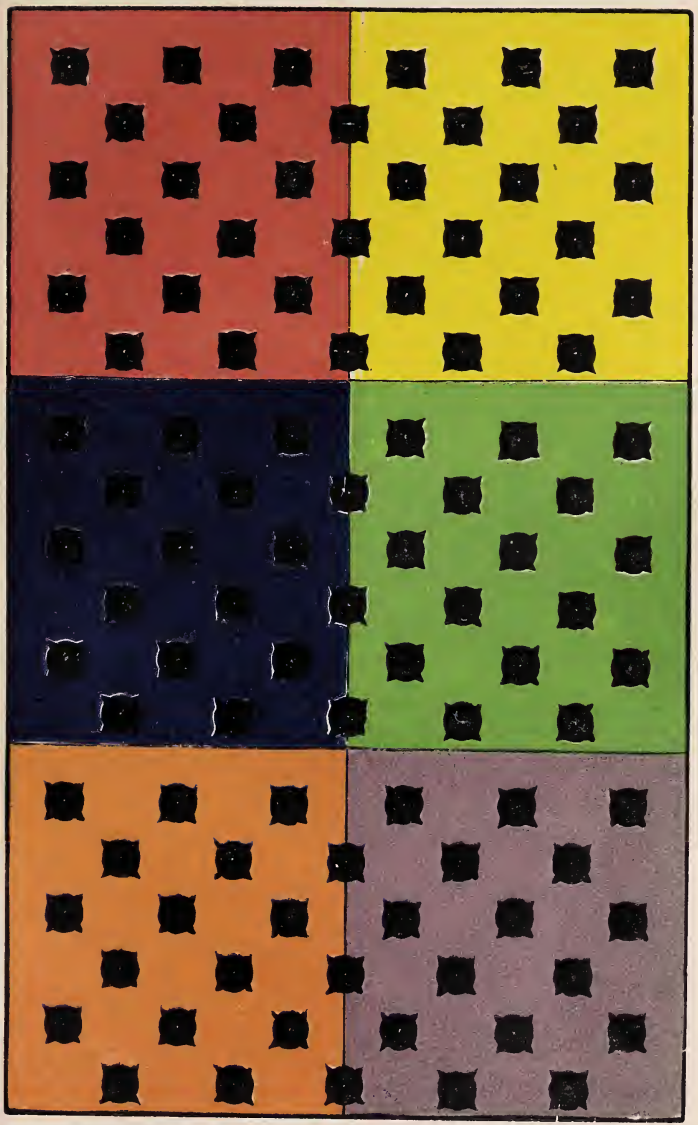


PLATE XIII. *Page* 120.

of which is very feeble, on account of the great contrast of tone.

Upon *Green* stuffs they appear of a *Reddish-grey.*

Upon *Blue* stuffs they appear of an *Orange-grey.*

Upon *Violet* stuffs they appear of a *Greenish-yellow Grey.*

These examples are sufficient to enable us to comprehend their advantage to the printer of patterns in colours complementary to the colours of the ground, whenever contiguous tints are to be mutually strengthened without going out of their respective scales.

DESIGNS FOR PAPER-HANGINGS.

375. The manufacture of paper-hangings has now arrived at such a point, that a knowledge of the law of contrast of colours is indispensably necessary to this branch of industry. We cannot estimate the true relations between the law of contrast and the art of paper-staining without dividing the papers into several categories to which the law is applicable.

1. Papers having figures and landscapes, or flowers of different sizes, and of varied colours, not intended for borders; these approach the nearest to painting.
2. Papers with patterns of one colour, or of colours but slightly varied.
3. Those employed as borders.

CHAPTER II.

On the Law of Simultaneous Contrast of Colours in relation to Paper-Hangings with Figures, Landscapes, or large Flowers of varied Colours.

376. The study which I recommend to artists occupied in fabricating paper-hangings, is in some measure

that immediately applicable to every pictorial composition, or, in other words, the tapestry of figures and landscapes. But, whatever be the merit of paper-hangings of this category, they are not sought by persons of refined taste, and they do not appear to me destined to be any more so in future, for the twofold reason that the taste for arabesques, painted upon walls, or upon wood, and that for lithographs, engravings, and paintings, is spreading every day. These last three objects exclude, at least, all those papers with figures and coloured landscapes.

377. The applications of the law of contrast to this class of paper-hangings are easy, when we thoroughly understand the divisions of the book to which I referred above. In order to prove the advantage to be derived from the knowledge of this law, I need only refer to the bad effect presented by contiguous bands of two tones of the same scale of grey (serving as the ground to the figure of an infant), in consequence of the contrast of tone arising from their juxtaposition (321).

378. *On the Law of Simultaneous Contrast of Colours in relation to Paper-hangings with Designs in a Single Colour, or in Colours but slightly varied.*

The remarks in 372 are applicable here also, as are those of 374. The best executed, and in the best taste, are those with black figures, or of figures much darker than the ground.

Paper-hangings, I do not say the most tasteful, but those most convenient for use, present very light grounds, with white or grey figures.

379. Grey patterns, upon papers tinted of a light colour, exhibit the phenomenon of maximum contrast; that is to say, the grey appears coloured with the complementary of the ground.



PLATE XIV.

Thus, conformably to the law, (Plate 14)

Grey patterns upon a *Rose* ground appear *Green.*

„ „ „ an *Orange* „ „ *Blue.*

„ „ „ a *Yellow* „ „ *Violet or Lilac.*

„ „ „ a *Green* „ „ *Rose.*

„ „ „ a *Blue* „ „ *Orange-grey.*

„ „ „ a *Violet* „ „ *Yellow.*

380. I mention these examples to instruct artists, for, in manufactories of paper-hangings, disputes arise between the proprietors and the preparers of the colours. For instance, a few years ago, the proprietors of one of the first manufactories in Paris, wishing to print grey patterns upon grounds of apple green and of rose, refused to believe that his colour-preparer had given any *grey* to the printer, because the designs printed on these grounds appeared coloured with the complementaries of the colour of the ground. It was only when the colour preparer, having attended a lecture I gave for M. Vauquelin, at the Museum of Natural History, and hearing me speak of the mistakes that these contrasts of colours might occasion, suspected the cause of the effects which he had unconsciously produced, and which had really caused him much annoyance.

OF THE LAW OF SIMULTANEOUS CONTRAST OF COLOURS RELATIVELY TO THE BORDERS OF PAPER-HANGINGS.

381. Every paper of one colour, or one belonging to the second category, should receive a border generally darker and more complex in design and colour than the paper which it frames.

The assortment of two papers exercises a very great influence on the effects they are capable of producing; for each of them may be of a fine colour, ornamented

with designs in the best taste, yet their effect will be mediocre, or even bad, because the assortment will not be conformable to the law of contrast.

382. The ground of a border contributes greatly to the beauty of the pattern, whether this be of flowers, ornaments, or any other object. As we cannot treat of this influence in an absolute or methodical manner, I shall select a certain number of remarkable facts which I have had occasion to observe, and I shall principally dwell on those from which we can deduce conclusions, which, apparently not flowing from previous observation, might escape many readers, in spite of the great interest they have in knowing them. Besides, the exhibition of these facts will give me occasion to apply the law of contrast to designs presenting many tones of the same scale, and of different hues, and also often of different scales, more or less distant from each other. I shall not treat of simple borders, presenting black or grey designs upon a uniform ground, for I have already spoken of the modifications which in this case black designs undergo (374), and grey designs also (379).

383. The design of a border, either of ornaments, flowers, or any other object, being cut out and pasted upon a white card, designs identical with the preceding, which had been pasted upon cardboard, were then cut out, and placed upon grounds of black, red, orange, yellow, green, blue, and violet; then compared, not only by myself, but also by many persons whose eyes are much accustomed to seeing colours. When we had perfectly agreed upon their value, the results were noted as follows :—

1.—BORDER OF EIGHT INCHES IN HEIGHT, REPRESENTING GILT ORNAMENTS UPON DIFFERENT GROUNDS.

Plate 15.

384. These ornaments, executed by the ordinary pro-

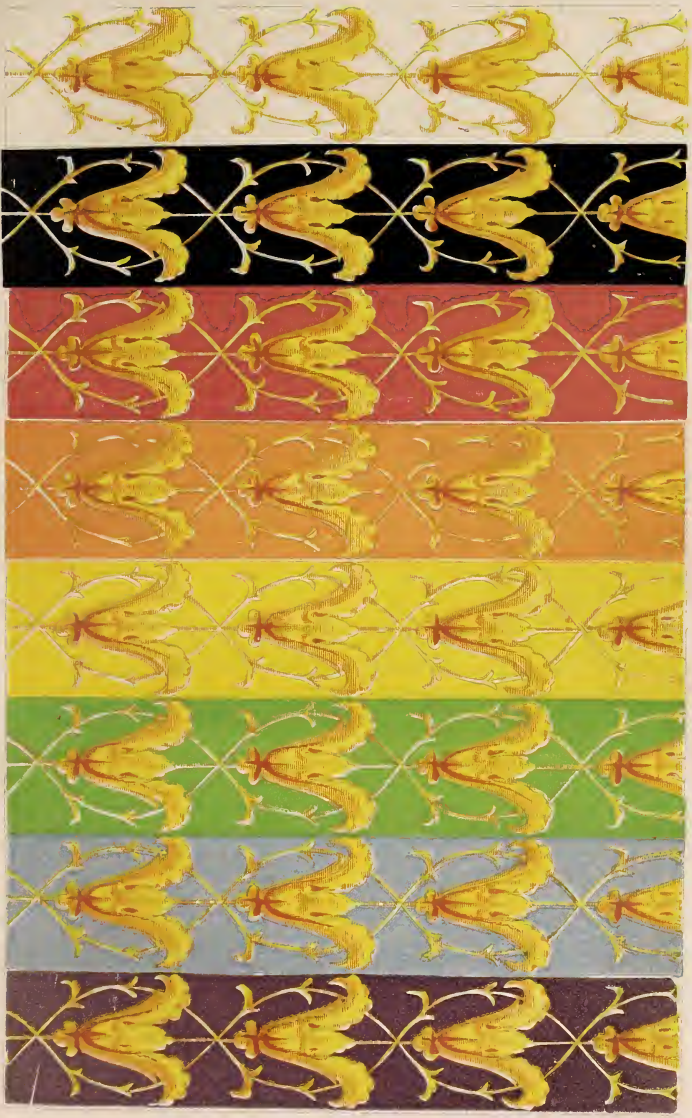


PLATE XV.

cesses of paper-staining, contained no particle of metallic gold; yellow, lakes, and orange, of different tones and hues, had been exclusively employed in their production. After having stated the modifications which the painted gilt ornaments experience from the colour of the grounds, I shall indicate those which the metallic gilt ornaments receive comparatively from the same grounds; this comparison presenting results which appear to me interesting.

Black Ground.

385. Painted gilt ornaments placed upon black ground, compared with the same ornaments placed on a white ground, appear much more distinct than the latter; because the yellows and orange-yellows, colours eminently luminous, and the black ground, which reflects no light, give rise to contrast of tone, which the white ground, essentially luminous, cannot give with the colours which are themselves luminous. (See 53.)

We perceive thus, that the colours placed upon black are lowered in tone; but it must be noted that yellows and orange-yellows, far from being weakened (58), would only cause the black to gain in purity.

In considering more particularly the effects of two grounds, we see that a black imparts a red to the ornaments, and it is important to remark that the brightness of this red, instead of reddening the yellows, really gilds them. (See 394.)

We may thus understand how black, in taking away some grey, imparts brilliancy, and how this grey, which may be considered as a tarnished or subdued blue, may, with yellow, produce an olive colour. It is also necessary to remark, that the gilt ornaments in question present an olive-grey tint, which, far from being diminished by the white ground, is exalted by it.

Although the black ground lowers the tone of the colours, while white heightens them, it lowers yellow more in proportion than red, and consequently renders the ornaments redder than they appear upon a white ground; and, in taking away the grey, it purifies the colours, and acts also by giving them some red, or by taking away some green.

Metallic Gilt Ornaments.

386. Gilt ornaments stand out better from black than from white, but the orange colour is weakened and really impoverished. The black ground then does not purify the real gilt ornaments as it does the painted imitation of gold.

Deep Red Ground.

The yellows are more luminous, the whole effect with the painted ornament is clearer, more brilliant, less grey than upon a white ground.

Red much deeper than the ornament, lowers the tone of it; and this effect is also augmented by the addition of its complementary, green, a bright colour.

This example is of much importance, enabling us to see how the red, which appears as though it could be of but little advantage to ornaments, because it tends to weaken them by making them greener, is notwithstanding favourable, because the lightening or weakening of the colour is more than compensated for by the brilliancy of the complementary of the ground which is added to the yellow. We shall return to this effect in a moment. There is this analogy between the influence of the red ground and that of the black ground, that the tone of the colour is lowered; but there is this difference, that the ornaments become green on the first, while they become orange upon the second.

387. The red ground is not so advantageous for gilt ornaments as it is for the painted imitations of them, because the metal loses too much of its orange colour, and appears inferior to gold upon a black ground.

The red ground appears darker, and more violet than the ground upon which painted ornaments are placed.

Grounds of a light red are still less favourable to the gold than red grounds of a dark tone.

Orange Ground deeper than the Ornaments.

388. The painted ornaments are bluer or rather greener than upon a white ground. The yellow and orange are singularly lower in tone.

This ground, then, is very disadvantageous to ornaments, as might have been expected.

389. Orange is not favourable to metallic gilt. The metal becomes too white, while the orange ground is redder and more vivid than that upon which the painted ornaments are placed.

Yellow Ground of Chromate of Lead more brilliant than the Yellow of the Ornaments.

390. The yellow of the painted ornaments is excessively enfeebled by the complementary of the ground which is added to it, the ornaments appear grey in comparison with those upon a white ground.

391. The yellow ground is not so unfavourable to gilt ornaments as it is to painted ones. The first assortment may, in certain cases, be recommended.

The yellow appears more intense, and perhaps greener.

Bright Green Ground.

392. Painted ornaments are darker upon a bright

green ground than upon a red or white ground. They have acquired some red, but not the brilliant tint which is given to them by black—it is a brick-red tint.

393. It follows from the comparison of the effects of ornaments upon red and upon green grounds, that the first is much more advantageous than the second, because it adds an essentially brilliant tint to the colour of the ornaments, while the latter, adding red, or taking away green, produces a brick-red.

394. Upon a bright green ground, *metallic gilt ornaments* acquire red, as the painted ornaments do, while the red, not sensibly diminishing the brilliancy of the metal, but, on the contrary, augmenting the intensity of its colour, produces an excellent effect.

The green ground is more intense and bluer than the same ground upon which the painted ornaments are placed.

395. The study of the effects of red and of green grounds upon painted ornaments, on the one hand, and upon gilt ornaments on the other, is extremely interesting to paperstainers and decorators; it demonstrates to them the necessity of taking into consideration, in the juxtaposition of bodies which it is proposed to associate, the brilliancy which these bodies naturally possess, and the brilliancy we wish to impart to them, if they have none. The preceding examples (386, 394) explain why the paperstainer will choose dark red instead of green for his gilt ornaments, and why a decorator will prefer green to red for the colour of the hangings of a show-room of gilt bronzes, gilt clocks, &c.

Blue Ground.

396. Observation agrees perfectly with the law that it is really upon a blue ground, that painted ornaments, whose

dominant colour is the complementary of blue, show themselves to the greatest advantage with respect to intensity of the gold-yellow colour. This effect more than compensates for the slight difference which may result from the red ground giving a little more brilliancy. The ornaments upon the latter ground, compared with those on the blue, are less coloured and appear whiter.

With *metallic gilt ornaments* the blue ground is deeper and less violet than with painted ornaments.

Violet Ground.

397. Conformably to the law, the violet ground giving greenish-yellow to the painted ornaments, is favourable to them ; they appear on this ground less olive-grey, more brilliant than upon the white ground, and less green than upon the red ground.

Metallic gilt ornaments stand out quite as well, the ground is raised in tone, and the violet appears bluer or less red.

398. It is remarkable that gilt ornaments, compared with their painted imitations, heighten all the grounds upon which they are placed. We cannot say that this metal causes the grounds to lose their brilliancy, for orange gaining some red, by the juxtaposition of the gold, appears, nevertheless, more brilliant than the orange in juxtaposition with the painted ornaments. The gold, by its orange colour, gives also some blue, its complementary, to bodies which surround it.

2.—BORDER OF FOUR INCHES IN BREADTH PRESENTING ORNAMENTS COMPOSED OF FESTOONS OF BLUE FLOWERS, OF WHICH THE EXTREMITIES ARE HELD BY GREY LEAVES OF ARABESQUES.

Plate 16.

399. These ornaments are opposed in some respects to the preceding by their dominant colour, which is blue.

Black Ground.

400. Grey lowered three tones in comparison with grey ; upon white less reddened.

Blue flowers lowered two tones at least.

Red Ground.

401. The grey is greenish, while upon white it is reddish.

The blue flowers are lowered three tones, and the blue inclines to green.

Orange Ground.

402. Grey much lowered ; less red than upon white.

Flowers paler, and of a blue less red or less violet, than upon a white ground.

Yellow Ground.

403. Grey higher than upon white ground, more violet.

Flowers of a more violet blue, less green than upon a white ground.

Green Ground.

404. The grey is reddish, while upon a white ground it appears greenish.

The blue gains red or violet, but it loses much of its

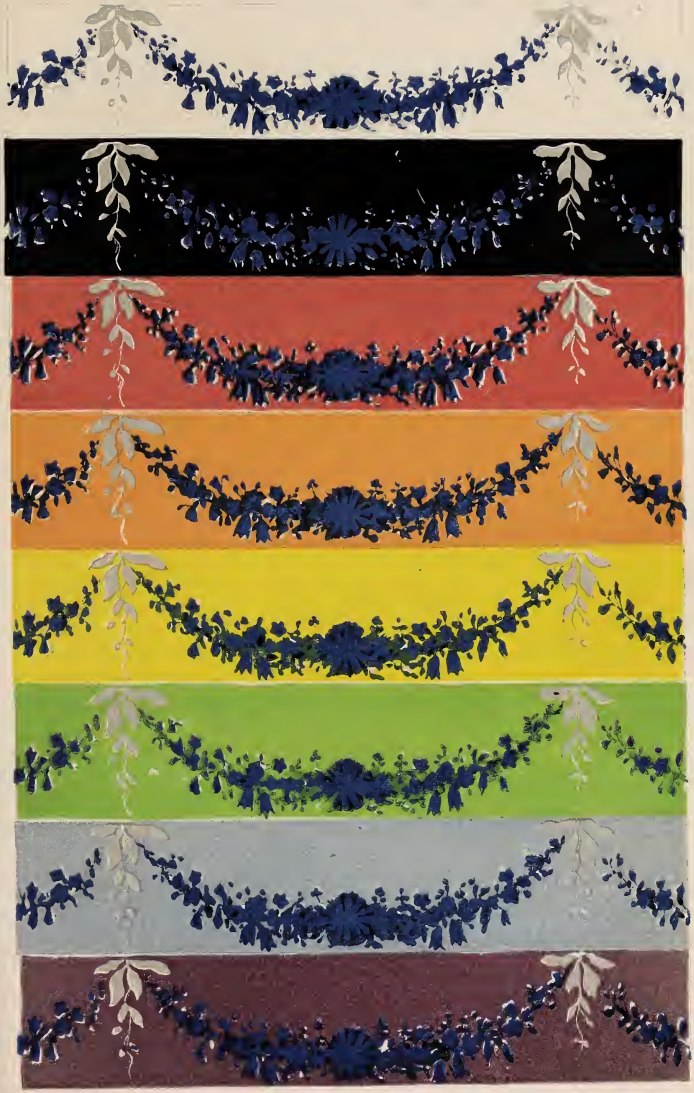


PLATE XVI.

Page 130.

vivacity; it resembles some blues of the silk-vat, which, giving yellow to the water, become slaty-blue-violet.

Blue Ground.

405. The blue ground being fresher than that of the ornament, it follows that it gives *orange* to the blue of the flowers; that is to say, it *greys* them in the most disagreeable manner.

The grey ornament is *oranged*, and lighter than upon the white ground.

Violet Ground.

406. Grey lowered, yellowed, impoverished. Blue tends to green, and is impoverished.

3.—BORDER OF FIVE INCHES AND A HALF IN BREADTH, REPRESENTING ROSES WITH THEIR LEAVES.

Plate 17.

407. This border is particularly useful as an example of the effect of two colours, red and green, which are very common in the vegetable world, and often represented upon paper-hangings.

Black Ground.

The green is less black, lighter, fresher, and purer, and its brown tones redder than upon a white ground. With respect to its lighter tones, I see them yellower, while, on the contrary, they appeared bluer to three persons accustomed to observe colours. This difference, as I at last found, arose from my comparing the general effect of leaves upon a black ground with that of leaves upon a white ground; while the other persons instituted their comparison more particularly upon the browns and the light tones of green, placed

upon the same ground. This difference in the manner of seeing the same objects will be the subject of some remarks hereafter.

Rose lighter, yellower than upon a white ground.

Dark Red Ground.

408. Green more beautiful, less black, lighter than upon a white ground.

Rose more lilac, perhaps, than upon a white ground. The good effect of the border upon this ground is due chiefly to the greatest part of the rose not being contiguous to red, but to green; because the border and the ground exhibit flowers, the rose of which contrasts with the green of their leaves; while the same green contrasts with the red of the ground, which is deeper and warmer than the colour of the flowers.

Orange Ground.

409. The green lighter, a little bluer than upon a white ground.

Red much more violet than upon a white ground.

The general effect not agreeable.

Yellow Ground.

410. Green bluer than upon a white ground.

Rose more violet, purer than upon a white ground.

The whole exhibits a good effect of contrast.

Green ground, the tone of which is nearly equal to that of the lights of the leaves, and the hue of which is a little bluer.

Green of the leaves lighter, yellower than upon a white ground.

Rose fresher, purer, more velvety than upon a white ground.

Ground of an agreeable effect from harmony of analogy



PLATE XVII.

Page 131.

with the colour of the leaves, and from harmony of contrast with the rose of the flowers.

Blue Ground.

411. Green lighter, more golden than upon a white ground.

Rose yellower, less fresh than upon a white ground.

Although the green leaves do not exactly produce a bad effect upon the ground, yet the roses lose much of their freshness, and the appearance of the whole is not agreeable.

Violet Ground.

412. Green yellower, lighter than upon a white ground.

Rose faded.

If the ground does not injure the green of the leaves, yet it injures the rose so much that it is not agreeable.

4.—BORDER OF SIX INCHES IN BREADTH, REPRESENTING WHITE FLOWERS, AS CHINA-ASTER, POPPY, LILY OF THE VALLEY, ROSES; SOME RED FLOWERS, AS THE ROSE-WALLFOWER; SOME SCARLET OR ORANGE, AS THE POPPY, POMEGRANATE, TULIP; BIGNONIA AND VIOLET FLOWERS, AS LILAC, VIOLETS, AND TULIPS WITH GREEN LEAVES.

413. This border was remarkable for the pleasing combinations of the flowers among themselves, and of the flowers with their leaves. In spite of the multiplicity of colours, and of the hues of red and violet, there was no disagreeable juxtaposition, except that of a pomegranate next to a rose; but the contact only took place at one point, and the two flowers were in very different positions.

Black Ground.

414. The whole lighter than upon a white ground.

Orange finer, brighter than upon a white ground.

White the same.

Green lighter, redder. The roses and the violets gain nothing from the black.

Red-Brown Ground.

415. The whole lighter than upon a white ground.

Whites and greens of fine effect. An orange-flower contiguous to the ground, for the reason explained above (407), acquires a brilliancy which it has not upon a white ground.

Orange Ground.

416. The whole more sombre, duller than upon a white ground. Orange-flowers and roses dull, lilacs bluer.

This assortment is not good.

Yellow Ground.

417. The orange-flower contiguous to the ground evidently loses vivacity in comparison with the white ground.

The whites are less beautiful than upon a red ground.

The greens are bluer than upon a white ground.

The roses become bluer, the violets acquire some brilliancy.

The whole effect is good, because there is but little yellow in the border, and but little orange contiguous to the ground.

Green Ground.

418. The ground being fresher than the green of the leaves, had not a good effect, relatively to them. On the other hand, the green in the border was in too small a

quantity to produce a harmony of analogy, and it had not sufficient red for a harmony of contrast.

Blue Ground.

419. The oranges have a fine effect, the greens were reddened as well as the whites. The roses and the lilacs lost some of their freshness.

This arrangement did not produce a good effect, because there was not sufficient yellow or orange in the border.

Violet Ground.

420. Orange more beautiful than upon a white ground.

Roses, and violets especially, less beautiful than upon a white ground. A poor assortment.

Grey Ground.

421. As might be easily foreseen, this ground was extremely favourable to all the colours of the border.

422. The examination we have just made of four sorts of borders enables us to verify the exactness of the conclusions which are directly deducible from the law of simultaneous contrast of colours, and presents to us effects which we could scarcely have deduced from the same law without the aid of experiment. I now speak—

1. Of the influence which a complementary exercises by imparting *brilliancy* to the colour to which it is added.
2. Of the very different manner in which not only different people, but even the same person, will

judge of the colours of a more or less complex pattern, having a certain number of colours, according to the attention the spectator gives at a certain moment to different parts (407).

423. Our examination of the border of roses with their leaves (No. 3), and especially of that of the border of flowers varied in their forms and hues (No. 4), shows the necessity of a knowledge of the law of contrast to assort the colours of objects represented upon a border with the colour which serves as a ground to them. The examination of the border No. 4 has demonstrated experimentally that this assortment presents so much the more difficulty as we wish to have purer tints for the ground, and more varied colours in the objects we intend placing on it; besides, in demonstrating the good effect of grey as a ground for these latter objects, it has furnished an example of a fact which may be deduced from the law, and which is in perfect accordance with what practice taught us long ago.

PRINTED OR WRITTEN CHARACTERS ON PAPERS OF DIFFERENT COLOURS.

424. Having made it a rule in this work never to state any observations which I have not myself verified, I must mention that, not possessing every requisite for the examination of the subject of this section, I am obliged to develop certain points of it only.

We must regard—

1. The duration of the reading, and

2. The kind of light which illuminates the printed or written paper.

A.—INFLUENCE OF DURATION IN THE READING.

425. From the different conditions in which the eye

is found when it is apt to perceive the phenomena of simultaneous, successive, and mixed contrasts of colours (77 *et seq.*), it may be conceived that in order to judge of the effect upon the sight of the assortments of the colour of the letters and that of the paper as to the degree of facility that they respectively present for reading, it may happen that one assortment will be more favourable during a brief reading, while the contrary will take place if the reading be prolonged during several hours. Besides, an assortment presenting the greatest contrast will be more favourable to a reading of short duration, while it will be less so to a prolonged reading; because, in consequence of the intensity of its contrast, it will fatigue the eye more.*

B.—INFLUENCE OF THE KIND OF LIGHT ON PRINTED OR WRITTEN PAPER.

426. The light we employ to supply the place of that of the sun, changing the relations of colour under which the same bodies appear to us illumined by daylight, it is evident that if we neglected this difference of relation it would give rise to error; because any assortment of colours favourable to read in diffused daylight, might be less so by the light of a lamp, &c.

427. I will now examine—

The influence of different assortments of the colours of writing and printing for reading by diffused daylight.

* Hence the pleasure of reading books printed on the modern *toned* paper. De Morgan advises that tables of logarithms, and the like, should be printed on pale brown paper.

ON THE ASSORTMENT OF COLOURS FOR READING BY DIFFUSED DAYLIGHT.

Reading of a Few Minutes' Duration.

428. Letters upon paper can be read without fatigue only when there is a marked contrast between the letters and the ground. This contrast may be of tone, or of colours, or both.

429. *Contrast of tone* is the most favourable condition for distinct vision, if we consider white and black as the two extremes of a scale, comprehending the gradations from normal grey; in fact, black letters upon a white ground present the maximum of contrast of tone, and may be read in a perfectly distinct manner without fatigue by diffused daylight. Indeed, all whose sight is enfeebled by age require the utmost contrast of tone.

FOURTH DIVISION.

Employment of Colours in Architecture.

I. ON THE EMPLOYMENT OF COLOURS IN EGYPTIAN ARCHITECTURE.

430. The Egyptians employed various colours, as red, yellow, blue, green, and white, to decorate their monuments.

Lancret remarks, "All who have seen Egyptian paintings, can attest that when seen, even for the first time, they were not disagreeable; and, that if at first the colours appear distributed arbitrarily, it is because observers have not combined a sufficient number of observations, and that it will one day be found that this part of the arts of the Egyptians was, like all the rest, submitted to invariable rules."

431. Champollion the Younger expresses himself in these terms on the application of colours to Egyptian architecture : "I should like to introduce into the great temple of Ipsamboul, all who refuse to believe in the elegant richness that painted sculpture adds to architecture; in less than a quarter of an hour, I engage that they would perspire away all their prejudices, and that their *à priori* opinions would quit them through every pore."

432. The fact of colouring hieroglyphics being once admitted, the colouring of the other figured objects which accompany them appears to have been a necessary consequence, either to bring out certain symbols, or allegories more distinctly and more agreeably, by the effect of their various colours, or because, if the hieroglyphics only were differently coloured, there would be no harmony between them and the other figured objects. No one can mistake the harmony between the hieroglyphics and other painted objects, and we therefore should not see any impropriety in them if we mistook them for figures traced by the capricious imagination of the artist. This harmony clearly justifies Lancret and Champollion the Younger, in the passages quoted above.

II. ON THE EMPLOYMENT OF COLOURS IN GREEK ARCHITECTURE.

433. The discovery of Greek temples coloured on the exterior is doubtless a very remarkable fact in archæology; for if any monuments seemed to reject the application of colours to their external decoration, it was assuredly those of the Greeks. At this day, it is impossible not to admit that it was among these people that the alliance of colours with architecture was made,

not in the declining epoch but at a period when monuments were erected in the best style; in fact, the ruins of coloured temples discovered by the excavations made in Greece, Italy, and Sicily, in places where many Greek colonies prospered, have this characteristic in a remarkable degree.

434. If we seek the cause which determined the Greek architect to seize upon one of the most powerful means that the painter has of addressing the eye, we shall find it especially, I think, in a taste for colours, rather than in the intention of rendering the various parts of an edifice more distinct from each other; and of substituting painted ornaments for ornaments in relief, whether sculptured or moulded, or of augmenting the relief these ornaments already possessed; indeed, the communication of the Greeks with the Egyptians may have induced them to imitate the latter in this application of colours to ornaments.

435. In the coloured drawings of Greek monuments which I have been able to procure, I have remarked not only the number of colours employed in these monuments, — *white, black, red, yellow, green,* and *blue,*— but also the use which has been made of them under the relation of *variety* and *purity of tint,* of *distinct view of the parts,* and of the *harmony of the whole.* For instance, the principal lines, as the fillets of the architrave and of the cornice, are *red;* the mutules *blue,* and their guttæ *white;* the triglyphs *blue,* their channels *black,* and their guttæ *white;* and the more extended parts of the frieze and the cornice, as well as the architrave, are of light *yellow.*

We see that *red,* a brilliant colour, indicated the greater part of the principal lines; that *blue,* associated

with *black* in the triglyphs and their channels, formed an harmonious and distinct union of the neighbouring parts: also that the dominant colour, light *yellow*, produced a much better effect than it would if the most intense or the most sombre colours had predominated. Finally, the colours were distributed in the most intelligent manner possible without being motley, presenting a variety and lightness in the tints, with easy separation of parts.

III. ON THE EMPLOYMENT OF COLOURS IN GOTHIC ARCHITECTURE.

436. In the great Gothic churches, colour has rarely been employed on the exterior, except in a few cases, and always in a restrained manner, and without injury to the general harmony; for the colour on porches and in niches is altogether insignificant in this point of view; and, besides, there is nothing to show that it was not added long after the erection of the structure on which it is found. One of the things I most admire in these vast edifices is the art, or, if you will, the luck, with which they have succeeded without colour, by having recourse only to architecture and sculpture, in giving to the exterior of the edifice a variety which in no respect injures the imposing effect of the whole.

437. If we now regard the interior of these churches, the magic of the colours of the stained windows will complete the enjoyments the sight can receive from colour allied to architecture—enjoyments which can only strengthen the power of the religious sentiment in all who enter these edifices to address their prayers to God. M. Boiserée, author of a work full

of research, as original as profound, on the cathedral of Cologne, thinks that the ceilings of Gothic churches ought, according to a general custom, to represent the celestial vault, and be painted blue, studded with gilt stars.

438. If painting has from the beginning really concurred with architecture, and even with painted sculpture, in the interior decoration of Gothic churches, it can only have been in a secondary degree and on the system of flat tints, from the time when it had been decided to put in windows of stained glass; for no painting applied upon an opaque body, such as stone, wood, &c., could sustain itself beside the brilliant coloured light transmitted by the glass; and if this painting had been graduated according to the rules of chiaro-'scuro, all its merit would have disappeared, for want of pure and white light, the only kind suitable for illuminating it.

439. Is it true that the vicinity of stained glass necessarily requires as an effect of harmony, painting on the contiguous walls? Without deciding absolutely in favour of the contrary opinion, I confess that, after reflecting long upon the deep impressions I have received in great Gothic churches where the walls present only the simple effects of light and shade upon a uniform surface of stone, where there are no colours except those transmitted by the stained glass, I say that the sight of more varied effects would have appeared to me an error against the principle of suitability of the place to its destination; and this opinion was especially fortified by seeing, after the coronation of Charles X., the fine vault of the ancient cathedral at Rheims, which had been painted for the occasion blue, sprinkled with *fleurs-de-lis*. I am reminded of the impression it produced upon me some years be-

fore, when it presented to my sight only the uniform colour of the stone.

APPLICATION TO THE INTERIORS OF EDIFICES.

440. I shall treat in succession—

1. On the assortment of stuffs with the wood of seats, &c.
2. On the assortment of frames with the pictures, engravings, and lithographs which they surround.
3. On the general decoration of interiors of churches.
4. On the decoration of museums, galleries, &c.
5. On the decoration of houses, palaces, &c.

On the Assortment of Stuffs with the Wood of Seats.

441. There should be between the two parts of the seat—the wood and the stuff—harmony of contrast and harmony of analogy. The beauty of the wood and of the stuff which accompanies it, may mutually enhance each other. From what has been said, it is evident that we must assort violet or blue stuffs with yellow woods, as the root of ash, the yew, satinwood, maple, &c. Green stuffs with rose or red-coloured woods, as mahogany, cherry-tree, rosewood, &c.

Violet, or blue-greys, are equally good with yellow woods, as green-greys are with the red woods.

But to obtain the best possible effect it is necessary to take into consideration the contrast resulting from depth of tone; for a dark blue or violet stuff will not accord so well with a yellow wood as a light tone of the same colours; and it is for this reason that yellow does not assort so well with mahogany, as with a wood of the same, but not so deep a colour.

442. Among the harmonies of contrast of tone that

can be made with wood, may be mentioned ebony, the brown colour of which permits its employment with light stuffs to produce contrasts of tone, rather than contrasts of colour. We can use it with very brilliant, intense colours; such as poppy, scarlet, aurora, flame-colour, &c.

443. When we employ painted woods instead of those which retain their natural colour, it is better for a stuff to give the wood such a colour as will best assort with the stuff. For assortments of this kind, I believe we cannot do better than refer to the examples of the assortments of the principal colours with white, black, and grey. (P. 49 *et seq.*)

444 Ebony wood, on account of its dark colour, be employed with dark stuffs to produce the assortments of analogy. In this case it can be allied with brown tones, and with red, blue, green, and violet. It is scarcely necessary to remark that these assortments prevent our using with ebony, white and yellow inlaying woods, which can be used with more or less advantage in those assortments which enter into the case of harmonies of contrast.

445. Frequent use is made of crimson woollen, velvet, and mahogany. This assortment, which is related to the harmony of analogy, is preferable to many others, only in consideration of the great stability of the colour of the stuff, and therefore independently of every idea of harmony. This induces me to examine it under several relations, that we may make the best possible use of it, according to the particular purpose.

When, in assorting crimson with mahogany, we wish to produce the harmony of analogy, by marking out the lines where the wood and the stuff touch, we can employ a cord or narrow galloon of yellow, or of golden

yellow with gilt nails ; or, better still, a narrow galloon of green or black, according to our wish to render the border more or less prominent.

When, in assorting these colours, we are guided by the twofold motive of the stability of the crimson colour and of the beauty of the mahogany, we must necessarily increase the distance which separates the stuff from the wood, by making the black or green border wider.

446. As the red woods always lose more or less of their beauty by the juxtaposition of red stuffs, we can never ally mahogany to colours which belong to the vivid reds, such as poppy or cherry ; and more particularly to orange-reds, such as scarlet aurora ; for these colours are so bright, that, taking away from this wood its peculiar tint, it becomes no better than oak or black walnut.

ON THE SELECTION OF FRAMES FOR PICTURES AND ENGRAVINGS.

447. If a frame is necessary to a picture, engraving, or drawing, to isolate it from the objects around it, it is always more or less injurious to the illusion the painter or designer has desired to produce, when it occupies its destined place. I only purpose here to examine the relation of colour between the frame and the object it surrounds.

448. Gilt frames accord well with large pictures painted in oil, when the latter do not represent gildings, at least so near the frame as to render it easy for the eye to compare the painted gold with the metal itself.

I will instance a bad effect from such proximity. A Gobelins tapestry, after Laurent, represents a genius armed with a torch, near which is a gilt altar, executed

in yellow silk and wool, all of which are entirely eclipsed by the metallic brilliancy of the gilt bronzes profusely spread over the mahogany frame of the tapestry. This may convince us that the richness of a frame may not only be a fault against art, but also against common sense.

449. Bronze frames which have but little yellow brilliancy do not injure the effect of an oil picture which represents a scene lighted by artificial light, such as that of candles, torches, a conflagration, &c.

450. When black frames, such as ebony, detach themselves sufficiently from an oil painting, they are favourable to large subjects; but whenever they are used, it is necessary to see whether the browns of the painting or drawing which are contiguous, do not lose too much of their vigour.

451. A grey frame is favourable to many landscape scenes painted in oil, particularly when the picture having a dominant colour, we take a grey lightly tinted with the complementary of that colour.

452. Gilt frames accord perfectly with black engravings and lithographs, when we take the precaution of leaving a certain extent of white paper round the subject.

453. To conclude. The rule to be followed in assorting a frame to a picture is, that its colour, brightness, and ornaments also, injure neither the colours, nor the shadows, nor the lights of the picture, nor the ornaments which it represents.

When we propose to put a border between the frame and an engraving, plain or coloured, we must take into consideration,—

1. The effect of the height of tone of this border upon the different tones of the design.

2. The effect of the complementary of the colour of the border upon the colour of the design.

3. The intensity of the diffused light which is considered most suitable to light the design. Because for a given border the mutual relations between the browns, the half-tints, the lights and the whites, change with the intensity of the daylight, and change more for a given composition with certain borders than with others.

A composition of small or medium size may be painted so that the artist himself will do well to choose the frame best adapted to it, and to paint up those parts of his picture which are contiguous to it. (See also 483.)

ON THE GENERAL DECORATION OF THE INTERIORS OF CHURCHES.

I now resume this subject, no longer to treat of it relatively to a given architectonic form, but to consider it under the most general point of view.

Conformably to the principle enunciated above (346), of judging the productions of art by the rules drawn from the nature of the materials employed, I establish two distinct classes of churches, not according to their form, but to a fundamental consideration which subordinates the interior decoration to the quality of the light, coloured or colourless, diffused through plain or coloured glass.

Stained Glass Windows.

1. From the bad effect of the mutual proximity of white and stained glass (365), it results that where one is employed in a church the other must be excluded, at least from the nave, choir, in a word, from all that

the spectator can embrace at one point of view. The colourless glass in some of the chapels of the aisles is of no consequence in the general effect.

2. If pictures be near stained windows, they must be flat, or present subjects as simple as possible, since their effects are entirely sacrificed to those of the stained glass (438).

3. We can place pictures in a large church where the light is transmitted through coloured glass; but, for the view to be satisfactory, they must necessarily encounter such a union of conditions, that they will almost always be found out of place. In fact, if the pictures are not at a certain distance from the glass,—if the coloured lights which emanate from them are not, by their mutual admixture, in the requisite proportions for producing white light, or, at least, a very faintly coloured light—or if this feebly coloured light is insufficient to lighten the interior of the church properly, the pictures will lose their colour, unless they have been executed with reference to the nature of the light from the stained windows; but this is not, to my knowledge, ever realized.

White Glass Windows.

454. Churches with white glass windows harmonize with every ornament we can imagine in the employment of wood, marbles, porphyry, granite, and the metals. Mosaics may ornament the floors and adorn the walls with true pictures, as we see in St. Peter's at Rome. Painting in fresco, in oil, plain and coloured sculptures, also combine to ornament the interior.

1. In churches of this class, the profusion of riches at the disposal of the decorator, far from being always

of advantage to him, may be the cause of difficulties; for, the more varied the objects he has to arrange, the greater the difficulty of presenting only such objects as are in keeping with the place he has to embellish. It is not enough to have precious woods, marbles, metals, pictures; he must also make these objects harmonize. Thus, he must avoid putting coloured marbles contiguous to the white stone of which the walls are constructed; he must also proscribe surrounding bas-reliefs in white stone with slabs or borders of red or green marble.

2. The cathedral of Cologne, for churches with *coloured* glass, and St. Peter's at Rome, for those with *white* glass, are two types which it will be sufficient to mention when we wish to demonstrate that beauty is compatible with different systems.

3. Much as I admire the marvels which the arts have accumulated in churches where white light freely enters, and although I acknowledge the effects which certain pictures of the first order are capable of producing in the Christian mind, yet the churches in which we see these decorations, resemble museums of art more than temples consecrated to prayer; and under this aspect they do not appear to me to fulfil the conditions imposed by the principle of fitness of edifices to their purpose in the same degree as Gothic churches with stained glass windows.

ON THE DECORATION OF MUSEUMS AND GALLERIES.

455. The essential condition which these edifices must fulfil, is, that the light be as white and as vivid as possible; but always diffused and distributed equally and in the most suitable manner upon all the objects

exhibited to the spectator, so that they may be seen without fatigue, and distinctly in every part.

Picture Galleries.

456. There is generally a disposition to be prodigal of ornaments and gilding in such buildings. Without pretending that all decoration should be proscribed, yet I believe that there is less disadvantage in erring by deficiency than by excess; in fact, the pictures, &c., are the precious objects, and it is to them that we must attract attention. Let me add, that one of the most injurious things to the effect of pictures is their accumulation—their being crammed all together; the position they then occupy, so different from that for which the painters destined them, diminishes the illusion which each would produce if it were in its proper place. Few, except the intelligent connoisseur and amateur, on seeing a picture exhibited in a gallery, experience all the effect which the artist wished to produce. Even the contiguity of the frame to the picture is destructive of the illusion of perspective: hence the difference between the effect of a framed picture and the effect of the same picture when seen through an opening, which permits us to see neither frame nor limits: it then recals all the illusion of the diorama.

Sculpture Galleries.

457. Statues of white marble or stone, as well as plaster casts, stand out well in a gallery, the walls of which are of a pearly-grey colour; and if we would augment the whiteness of the statues by neutralizing the red hue which the marble, stone, or plaster might have, we could colour the walls with a chamois or orange-grey tint. If, on the contrary, we preferred giving to

the statues a warm colour, which many sculptors esteem so highly, the walls must be of blue-grey. Green walls will give to the statues a rosy tint, which is not disagreeable.

The tone of their colour must be lower, the brighter we wish the sculptures to be.

458. When there are bronzes, the colour of the walls of the gallery must be determined by that which we wish to predominate in the statues; because, as is very well known, the metallic alloy of which they are formed yields two very different tints; one *green*, acquired by exposure to atmosphere; the other the peculiar *golden* tint which it possesses where it is not oxidized. If we wish to exalt this green tint, the colour of the walls of the gallery must be *red;* while they must be *blue* to bring out the brilliancy of the metallic bronze, which has not experienced the action of the atmosphere.

459. The walls of the gallery are considered as giving rise to effects of contrast, and not of reflection.

Museums of Natural History.

460. In these edifices it would be wrong to give the walls any positive colour, for the objects exhibited should appear to the eyes of the naturalist of the colour peculiar to each; consequently the interior of cabinets, glass-cases, and drawers must necessarily be white, or normal grey, very light in tone.

Wainscoting.

461. From the fact that wainscotings are generally concealed by the furniture placed before them, we may conclude that they must be of a dark, rather than of a light colour, and that, if they have ornaments, these must

be simple, and not prominent. The wainscoting may be considered as serving as a ground to the furniture, whenever it is not entirely concealed by the latter. We shall see hereafter what colour is necessary to be given them that they may suit their purpose.

DECORATIONS OF THE INTERIOR OF HOUSES.

Hangings.

462. In consequence of an apartment never being too light—for we can always diminish superfluous light—hangings should be of a light colour, that they may reflect, not absorb, light.

463. We proscribe all dark hangings, whatever be their colour, because they absorb too much light; we proscribe also red and violet hangings, because they are exceedingly unfavourable to the colour of the skin. For this latter reason we reject the light tones of the red and violet scales. Orange is a colour that can never be much employed, because it fatigues the eye too much by its great intensity.

1. Among the simple colours, there are scarcely any which are advantageous, except yellow and the light tones of green and of blue. Yellow is lively; it combines well with mahognany furniture, but not *generally* with gilding (see 469).
2. Light-green is favourable to pale complexions as well as to rosy ones; to mahogany furniture, and to gilding.
3. Light blue is much less favourable than green to rosy complexions, especially in daylight; it is particularly favourable to gilding, it does

not injure mahogany, and associates better than green with yellow or orange woods.

4. White or whitish hangings of a light grey (either normal green, blue, or yellow), uniform or with velvet patterns of the colour of the ground, are also very useful.

5. When we would choose hangings upon which to place a picture, their colour must be uniform, and make the greatest contrast possible with that which predominates in the picture, if the hangings are not of a normal grey. I shall return to this assortment (483).

464. Hangings in the best taste are those—

1. Which present designs of a light tone, either normal or coloured grey, upon a white ground, or the reverse, and in which the pattern is at least equal in extent of surface to the ground; for a small pattern has a very poor effect, at least in a large room.

2. Patterns of two or more tones of the same or very near scales assorted conformably to the law of contrast.

465. Hangings of brilliant and varied colours representing real objects, forming patterns more or less complex, do not admit of pictures; and as such hangings should exhibit themselves distinctly, they must not be concealed by the furniture in any of their parts.

466. When we have to adapt a border to a monochromous hanging, or to one presenting a dominant colour, we must first determine whether we can have recourse to a harmony of analogy or to a harmony of contrast; in all cases the border ought to detach itself more

or less from the hangings, which it is intended to surround and separate from contiguous objects.

Harmony of contrast is the most suitable to papers of a uniform pure colour, such as yellows, greens, and blues; consequently we recommend for the dominant colour of the border, the complementary of that of the hangings, whether this border represents ornaments, arabesques, flowers, or imitations of fringes or tissues. But, as a contrast of colour ought not generally to offer also a contrast of tone, then the general tone of the border must only surpass that of the hangings so far as to avoid a deadening effect. If a double border be required, the exterior border must be of a much deeper tone than the other, and always narrower.

467. Among the colours suitable for borders we recommend the following as harmonies of contrast:—

1. For yellow hangings, violet and blue mixed with white; if a fringe, of flowers garnished with their leaves, or ornaments.
2. For green hangings, red in all its hues; the painted gilt-yellows upon a dark-red ground; the borders of brass.
3. For white hangings, orange and yellow; the borders of brass or gilt moulding: these are much better on blue than on green.

468. Among the harmonies of analogy, I recommend the following:—

For yellow hangings, a border of brass or gilt moulding.

White or Whitish Hangings of Normal Grey, Pearl Grey, or very pale coloured Grey, of a uniform colour, or with a Velvet Pattern of the Colour of the Ground.

469. Although papers of this kind admit of borders of all colours, yet we must avoid too great a contrast of tone in a border containing pure colours; for the intense tones of blue, violet, red, green, are too crude to combine with these light grounds. Gilt brass borders accord well with these grounds, especially with the pure or grey whites. If a grey present a tint of green, of blue, or of yellow, we may use borders of the complementary of these tints, taken many tones above, or of a grey, deeply tinged with this complementary.

470. Among the harmonies of analogy, we may take for grey hangings, borders of some tones higher, and of a grey contrasting with their tint, but very lightly.

For Borders of Hangings that present a pure Colour with White, or many Tones belonging either to the same Scale or to contiguous Scales (see 466).

For *chintzes*, we must have analogous borders.

For larger patterns than chintzes, repeated like the latter, a binding of galloon suffices.

Hangings with human figures, landscapes, or other pictures, require a frame either of painted, gilt, or bronzed wood, or, better still, a border imitated by painting.

Colour of the Wainscoting relatively to the Hangings.

When the Hangings and the Border make a Contrast of Colour.

471. The dominant colour of the wainscoting must generally be more or less approximating, and may be—

1. The same as that of the border, but a little darker, and especially more or less broken with black.

2. Grey lightly tinted with the colour of the border, and of the same tone, or very near it.

3. The complementary of the colour of the hangings, when the dominant colour of the border is not its complementary. If we employ a complementary lightly broken with black, the moulding must be picked out in brown on the border and on the wainscoting.

4. A grey complementary to the colour of the hangings, when the border is not the complementary of the hangings.

In these cases we bring out upon the colour of the hangings, properly so called, that of the wainscoting, which we always render more or less dull. Thus the colour of the hangings and the wainscoting are agreeably harmonized, and the border suitably separates them.

5. A normal grey of many tones, with which we may combine white.

472. When the colour of the wainscoting is the same as that of the hangings, but duller or deeper, in general it has a poor effect, arising particularly from the fact that the colour of the border, which contrasts with that of the hangings and of the wainscoting, is in too small superficial proportion to the other.

When the Assortment of the Hangings and the Border make either the Harmonies of Contrast of Scale or of Contrast of Hue, or the Harmonies of Analogy.

The dominant colour of the wainscoting may be—

1. The complementary of the colour of the hangings, but more or less broken, and a little deeper.
2. Grey complementary to the colour of the hangings.
3. A colour which, without being complementary, contrasts with that of the hangings.
4. Grey, tinted by a colour which, without being

complementary to that of the hangings, contrasts with them.

473. When the hangings are white, or of an extremely feeble tone of colour, and the border does not stand out very strongly by its colour, we may make a harmony of tone or of hue with the tint of the wainscoting. For example, white, or nearly white hangings, with a gilt or brass border, harmonize well with a wainscoting which differs only by some tones more from the colour of the hangings.

Cornice of the Ceiling.

474. The cornice of a white ceiling must be of light colours, and but little varied; not according with those of the hangings, but of the wainscoting. White parts, which may be confounded with the ceiling, must be carefully avoided, as must also whatever will cause too much difference between the parts of the whole. When the hangings are white, or of a very pale grey, with a gilt or brass border, the cornice may present ornaments of the same material, and in this case they may stand upon a white or upon a grey, a little deeper than that of the hangings.

Chairs, Sofas, &c., placed in front of the Wainscoting or Hangings.

475. The colour of the covering of chairs should be complementary to that of the hangings, properly so called, or, more generally, the same as that of the border, because this may be different from its complementary, and contrast, nevertheless, with the tint of the hangings. We see, then, that the chairs should contrast with the hangings, as may also the wainscoting; but the colour

of the chairs being pure, it will also be purified by that of the wainscoting, which, for this reason, we have advised to be deadened.

1. The case of clearest contrast—*i.e.*, when the colours of the hangings and the chairs are complementary —is the most favourable to distinct vision, as well as to successive contrast, whenever we observe first the hangings separately, and afterwards the chairs separately, and *vice versâ*.
2. When the colour of the hangings and of the chairs contrast without being complementary, we must take into consideration the degree of *light* in the colour of the hangings. For example, if they are blue, and the border is yellow, the covering of the furniture being a yellow, more golden than citron, this stuff must be of a much higher tone than the blue tone of the hangings; and the tone of the wood of the chairs, &c., must be still higher than the yellow, to avoid a dull appearance.
3. We may border the stuff at the parts contiguous to the wood, either with well-assorted dark colours, or with the same colour as the hangings, but of a higher tone; there is also a means of harmonizing the hangings and the furniture, in uniting the same colours, but in inverse proportion.
4. When, instead of sofas, arm and other chairs, there is a *divan* which entirely conceals the wainscoting, we must use the complementary colour of the hangings, when it is more advantageous for the colour of the border to form a contrast of scale or of hue with the hangings. In this case,

yellow hangings bordered with brass in relief with a violet-coloured divan, will produce an excellent effect, at least by daylight; for we must not forget that yellow and violet lose in artificial light.

5. We regard as a harmony of contrast of colour light hangings of a pure colour with furniture of a grey, tinted with the complementary to that of the hangings.

476. Rooms differing in dimensions, according as they belong to the lively or grave harmonies, will be adapted to very different purposes.

1. In small rooms—such, for example, as boudoirs, where the hangings are bright—a harmony of contrast of hue, of scale, or a harmony of analogy, is generally preferable to a harmony of contrast of colour, if the hangings are uniform, or have a dominant colour. If they have a decided colour allied to white, or if they present patterns of various colours, such as *chintzes*, the furniture most suitable will be a divan of the same material as the hangings; and it is conformable with the object of boudoirs, or of similar places, to diminish their apparent extent to the eye, by employing only one material for the hangings and the chairs, instead of seeking to fix the eye upon distinct objects.

2. In large rooms there is an arrangement of good effect—viz., white, or very light grey hangings, with furniture of a pure colour, such as red, yellow, green, blue, and violet. When we employ these pure colours, we must heighten the tone only so much as to avoid a faded appearance. Sky-blue is the most suitable for this arrangement; crimson, which is also employed, is

too harsh, especially if the room is neither very large nor well lighted.

477. *Grave Assortments* are adapted to places devoted to quiet meetings, such as libraries, museums, studies, &c. In general, the smaller the place, or the less space there is to receive the hangings, the more the assortment must be that of a harmony of analogy.

The hangings or the pictures must present only normal grey, or a grey of a colour more or less broken; the chairs must be black or of a dark grey, either normal or coloured; and in this case we can take a grey tinted with the complementary of the colour of the grey of the hangings. If more contrast is desired, we can have recourse to the brown tones of this complementary of the colour, which tints the grey of the hangings.

478. *Window and Bed-curtains* should be similar to each other.

When the Chairs have a decided Colour—such as Red, Yellow, Green, Blue, or Violet—the hangings should be of a pure colour, contrasting favourably with that of the chairs.

The curtains should generally be of the colour of the chairs, and their borders of the colour of the hangings, or of the colour of the hangings bordered with the colour of the chairs.

The Chairs being Grey, or of a very subdued Colour, and the hangings of a decided colour, the curtains should be either,—1. Of the colour of the chairs, with a border of the colour of the hangings: or, 2. Of the complementary of the hangings, or contrasting favourably with them; the colour of the border should be that of the hangings.

The Hangings being of a Grey Colour, or White, the curtains should be,—1. Of the colour of the chairs: or, 2. Of a pure colour, complementary to the grey of the hangings, if the latter do not belong to the scale of normal grey.

479. *Doors.*—Doors being, by their use, size, and position, relatively to the plane of the wall, absolutely distinct from the wainscoting, should be distinguished from it by their colour, notwithstanding the contrary practice of painters, who make them the same. Their different parts might be painted in many low tones of the same, or of approximating scales, and always according to the harmony of analogy, as the parts of one object are concerned. The colour of the doors should be of normal grey, or of a grey tinged with the colour of the hangings or of its complementary, which will thus always unite with the hangings, either by harmony of analogy, or by harmony of contrast. The door frames should be darker than the door itself.

480. *Window Frames* should be like the doors, according to a rule which has long been generally observed. The fastenings must be black, bronzed, or of brass.

Carpets.

481. Whatever may be the dominant colours of the subjects represented in their central part, with regard to brilliancy and contrast, they should always be separated from the chairs by a sufficient interval to prevent discord with the colour of the latter.

1. The more numerous and vivid the colours are, the more we must control their brilliancy; and the carpet most suitable will be one of simple colours and pattern.

In many cases, an assortment of green and black will have a good effect.

2. If the furniture is of a single colour, or of many tones, either of the same colour or of approximating scales, we can, without disadvantage, employ a carpet of brilliant colours, and thus establish a harmony of contrast between them and the dominant tint of the furniture.

482. But if the furniture is of mahogany, and we wish to bring out its colour, then we must not have either red, scarlet, or orange as a dominant colour in the carpet.

In short, to get the best effect of the colours of the furniture, in the first case, the colours of the carpet, more or less sombre, must enter into the harmonies of analogy; while in the second, where harmony of contrast of colour does not exist in the furniture, we can, if we choose, have recourse to this harmony in the carpet without ill effect.

Pictures (See 453).

483. Whenever pictures are placed on hangings, the latter must be of a single colour, or of two very similar colours or tones of the same scale. The pattern of these hangings must be as simple as possible. Whenever a picture is placed on coloured hangings, we must always take care that the dominant colour of the hangings be complementary to the dominant colour of the picture.

Engravings and plain lithographs must never be placed beside oil paintings, or even coloured drawings.

Pearl-grey, or rather deep normal grey, is a good tint to receive engravings and plain lithographs in gilt or yellow wood frames.

484. Yellow hangings can receive with advantage landscapes, in which green grass, and leaves, and a blue sky predominate. The most suitable frames in this case are those of violet ebony, or wood painted grey or black. Gilt frames have not a bad effect on the picture; but the gold of the frame and the yellow of the hangings do not contrast sufficiently to most eyes.

485. Oil-paintings in gilt frames have a good effect on hangings of olive-grey more or less deep, according to the tone of the picture. Carnations and the gold assort well on a similar ground. Papers of a deep green, and even of a deep blue, may also be advantageously employed in many cases.

ON THE ASSORTMENT OF COLOURS IN INTERIORS, THE WALLS OF WHICH ARE PANELLED OR COVERED WITH MARBLE, STUCCO, OR PAINTED WOOD.

Panelled Interiors.

486. Notwithstanding the present taste for decorations, which it is so easy to satisfy by means of paper-hangings, woven fabrics, and other accessories, I think there are in large suites of apartments two rooms for which a paneling more or less finished is very suitable; these are the dining and the billiard rooms; the scene being, as it were, concentrated on the dining or billiard tables, there is no reason to distract the attention by clothing the walls with ornaments. Where an interior is paneled, the floor should be in parquetry; a pavement of tiles, stones, or marbles would be out of keeping.

487. The colour of the curtains, for paneled interiors, must be chosen conformably to the preceding principles. For example—

White curtains will heighten the tone of the woodwork;

Blue curtains will bring out the golden tint of many woods, especially of polished oak.

Interiors covered with Marbles.

488. We can arrange marbles together on the principle of harmony of contrast or of harmony of analogy. Bronze adapts itself to them very well. If granite and porphyry are to be added, the lower courses must be composed of the latter.

Blinds are preferable to curtains, which are not suited to marbles.

Interiors covered with Wood painted of several Colours.

489. The painting on a wainscot which is not beautiful enough to be seen uncovered has for its object the imitation—1. Of hangings; 2. Of wood more or less costly; 3. Of marble.

490. When we decorate walls of a pale grey ground, which require to be warmed with arabesques, we must endeavour to imitate pictures rather than mosaics.

491. The more carefully arabesques are executed, the more variety they will present in their forms and colours, and the less they should resemble the draperies, with which they are associated. Thus, white curtains with a simple and ample border, or curtains of a slightly-elevated tone of colour, or of an extremely simple design, should have the preference to curtains which are related to arabesques by their vivid colours, their varied patterns, or striking colour; in short, the colour of the curtain, if it has any, must be sacrificed to that of the arabesques.

Fifth Division.

CLOTHING.

492. In explaining the applications of the law of contrast to the colours of Male Clothing, my intention is to discuss principally the question of the combination of colours in military uniforms as a matter of State economy; and, in the case of Female Clothing, the combinations which are most suitable for a portrait. The first question is entirely one of administrative economy; the second belongs solely to the domain of art.

I shall attain my end if, in the views set forth, the portrait-painter find the means of selecting associations of colours which, by imparting to his works more brilliancy and harmony, render them thereby less likely to appear antiquated when the prevailing fashion of his time is forgotten.

I. *Men's Clothing.*

493. A dress composed of cloths of different colours may be worn much longer, and will appear better, although nearly worn out, than a suit of a single colour, even when the latter is of a piece of cloth identical with one of the first. The law of contrast fully gives the reason of this fact.

OF THE ADVANTAGES OF CONTRAST, CONSIDERED WITH REGARD TO THE APPARENT CLEANLINESS OF CLOTHS FOR CLOTHING.

494. Contrast in the colours of cloths composing a dress is not only advantageous to the brightness and *apparent preservation* of the colours of these cloths, but

also to render less visible the inequalities which a cloth presents on account of the colouring material not having equally penetrated to the centre of the stuff; the surface wearing unequally, according as it is exposed to different degrees of friction, the colour of the cloth becomes lighter, or, as it is commonly called, *whitens*, in the parts most exposed to friction. Many blue, scarlet, and madder-red cloths present this result, especially on the salient parts of the vestment, such as the seams.

495. This defect which certain cloths have of *whitening in the seams* is much less apparent in a coat of two or more colours than it is in a monochromous coat; because *the vivid contrast of different colours, fixing immediately the attention of the spectator, prevents the eye from perceiving the inequalities, which would be visible in a monochromic coat.*

For this reason stains, on the same ground, will always be less apparent in a polychromous than in a monochromous garment or dress.

496. For the same reason also a coat, waistcoat, and trousers of the same colour cannot be worn together with advantage, except when new; for when one of them has lost its freshness, by having been more worn than the others, the difference will be increased by contrast. Thus new black trousers worn with a coat and waistcoat of the same colour, but old and slightly *rusty*, will bring out this latter tint, while at the same time the black of the trousers will appear brighter. White trousers or reddish-grey will correct the defect. We see, then, the advantage of having a soldier's trousers of another colour than his coat, especially if, wearing this coat all the year, he only wears

trousers of the same cloth during winter. We see also why white trousers are favourable to coats of every colour.

II.—*Female Clothing.*

497. Although there are many varieties of the human race with respect to the colour of the skin, yet we may arrange them in the three following divisions:—The Caucasian, or white race; the American Indians, whose skin is red or copper-coloured; the negro race, the Malays, &c., who have black or olive skins.

Colours for the Dress of Women with White Skins.

498. To give precision to this subject, we must begin by establishing certain distinctions.

1. That of the two types, with skins more or less white and rosy:—

The one with light hair and blue eyes.

The other with black hair and black eyes.

2. That of the juxtaposition of the articles of the toilet, whether pertaining to the hair or to the complexion; for a colour may contrast favourably to the hair, yet produce a disagreeable effect with the skin.

3. That of the modifications of the complexion, by coloured rays emanating from the head-dress, and which, being reflected on the skin, tinge it with their peculiar colour.

499. The colour of light hair being essentially the result of a mixture of red, yellow, and brown, we must consider it as *a very pale subdued orange-brown;* the colour of the skin, although a lower tone, is analogous to it, except in the red parts. Blue eyes are really the only

parts of the fair type which form a contrast of colour with the whole; for the red parts produce, with the rest of the skin, only a harmony of analogy of hue, or at most a contrast of hue, and not of colour; and the parts of the skin contiguous to the hair, the eyebrows, and eyelashes, give rise only to a harmony of analogy, either of scale or of hue. The harmonies of analogy, then, evidently predominate in the fair type over the harmonies of contrast.

500. The type with black hair shows the harmonies of contrast predominating over the harmonies of analogy. The hair, eyebrows, eyelashes, and eyes, contrast in tone and colour, not only with the white of the skin, but also with the red parts, which in this type are really redder, or less roseate, than in the blonde type; and we must not forget that a decided red, associated with black, gives to the latter the character of an *excessively deep* colour, either blue or green.

Of the Colours of the Hair and Head-dress.

501. The colours which are usually considered as assorting best with light or black hair, are precisely those which produce great contrasts; thus, sky-blue, known to accord well with blondes, is the colour that approaches the nearest to the complementary of orange, which is the basis of the tint of their hair and complexions. Two colours, long esteemed to accord favourably with black hair—yellow, and red more or less orange—contrast in the same manner with them. Yellow and orange-red, contrasting by colour and brilliancy with black, and their complementaries, violet and blue-green, in mixing with the tint of the hair, are far from producing a bad result.

Of the Colours of the Complexion and the contiguous Drapery.

502. The juxtaposition of drapery with the different flesh tints of women offers to portrait-painters a host of remarks, which are all the results of the principles already laid down. We shall state the most general: thus—

503. ROSE-RED cannot be put in contrast with even the rosiest complexions without causing them to lose some of their freshness. *Rose-red, maroon,* and *light crimson* have the serious disadvantage of rendering the complexion more or less green. This is shown in the following experiment:—

Place two sheets of paper of either of the above colours beside two sheets of flesh-coloured paper, when it will be seen how much they are mutually injured, the lighter becoming greenish, and the darker rather of a violet hue. By substituting light green for the red, we shall find them mutually heightened and improved. The height of tone of the green influences the result: a very deep green, acting by contrast of tone, so enfeebles the complexion, that the slight contrasts of its colours will be inappreciable; a deep red, by contrast of analogy, blanches the complexion. It is necessary, then, to separate the rose from the skin, in some manner; and the simplest manner of doing this, is to edge the draperies with a border of *tulle,* which produces the effect of grey by the mixture of white threads, which reflect light, and the interstices, which absorb it; there is also a mixture of light and shade, which recals the effect of grey, like the effect of a casement-window viewed at a great distance. Dark red is less objectionable for certain complexions than rose-red, because, being higher than

the latter, it tends to impart whiteness to them in consequence of contrast of tone.

504. Delicate Green is, on the contrary, favourable to all fair complexions which are deficient in rose, and which may have more imparted to them without disadvantage. But it is not as favourable to complexions that are more red than rosy; nor to those that have a tint of orange mixed with brown, because the red they add to this tint will be of a brick-red hue. In the latter case a dark green will be less objectionable than a delicate green.

505. Yellow imparts violet to a fair skin, and in this view it is less favourable than the delicate green.

To those skins which are more yellow than orange it imparts white; but this combination is very dull and heavy for a fair complexion.

When the skin is tinted more with orange than yellow, we can make it rosy by neutralizing the yellow. It produces this effect upon the black-haired type, and it is thus *that it suits brunettes.*

506. Violet, the complementary of yellow, produces contrary effects; thus it imparts some greenish-yellow to fair complexions. It augments the yellow tint of yellow and orange skins. The little blue there may be in a complexion it makes green-violet. This, then, is one of the least favourable colours to the skin, at least when it is not sufficiently deep to whiten the skin by contrast of tone.

507. Blue imparts orange, which combines favourably with white, and the light flesh tints of fair complexions, which have already a more or less determined tint of this colour. Blue is thus suitable to most blondes, and in this case justifies its reputation.

It will not suit brunettes, since they have already too much of orange.

508. Orange is too brilliant to be elegant; it makes fair complexions blue, whitens those which have an orange tint, and gives a green hue to those of a yellow tint.

509. Lustreless White, such as cambric muslin, assorts well with a fresh complexion, of which it relieves the rose colour; but it is unsuitable to complexions which have a disagreeable tint, because white always exalts all colours by raising their tone; consequently it is unsuitable to those skins which, without having this disagreeable tint, very nearly approach it.

510. Very Light White draperies, such as muslin or lace, appear more grey than white. (See 503.) We must thus regard every white drapery which allows the light to pass through its interstices, and which is only apparent to the eyes by the surface opposed to that which receives incident light.

511. Black draperies, by lowering the tone of the colours with which they are in juxtaposition, whiten the skin; but if the vermilion, or rosy parts, are somewhat distant from the drapery, it will follow that, although lowered in tone, they appear relatively to the white parts of the skin contiguous to the same drapery, redder than if not contiguous to the black. This effect is analogous to that mentioned (385).

The Head-dress in relation to the Coloured Rays which it may reflect upon the Skin.

512. The effect of coloured bonnets on the complexion can now be readily understood; and whether it is true, as is generally believed, that a rose-coloured bonnet

gives a rose tint to the skin, while a green bonnet gives a green tint to it, in consequence of the coloured rays which each of them reflects upon it, it is no longer a question about those head-dresses which, being too small or too much thrown back to give rise to these reflections, can only produce the effects of contrast, as I have said above, when treating of the juxtaposition of coloured objects with the hair and skin (501, *et seq.*)

513. If an object in relief is illuminated exclusively by a coloured light, it will appear tinted with the colour of this light. A white plaster figure, for example, placed in an enclosure where the red rays illuminate it, will appear red, at least to most eyes, and under most circumstances; for certain eyes, in some cases, may perceive the sensation of the complementary of the coloured rays in looking at some parts of the figure.

514. But if the figure is placed so as to receive, at the same time, coloured rays and diffused daylight, there will be produced on the eyes of a spectator, suitably placed, a complex effect; resulting—

1. From some parts of the figure being white, reflecting to the eyes of the spectator the coloured rays falling from above.

2. From some parts of the figure reflecting diffused daylight in sufficient quantity to appear white, or almost white.

3. From there being between the parts which reflect coloured light to the eye, and those which send diffused daylight, some parts in a condition which appears to be complementary to the reflected coloured light.

515. One very remarkable consequence of this is, that the rays of mutually complementary colours, successively

lighting the same object, concurrently with the diffused daylight, give rise to *the same coloration.*

516. This may be proved thus:—Between two windows directly opposite to each other, admitting diffused daylight, place a white plaster figure in such a position that each half shall be lighted directly by only one of the windows. On completely intercepting the light of one of the windows, and hanging a coloured curtain before the other, the figure appears only of the colour of the curtain; but if we open the other window, so that the figure is lighted by diffused daylight, while it is at the same time lighted by the coloured light, we then perceive some parts white, and some parts tinted with the complementary of the coloured light transmitted by the curtain.

517. This experiment, then, teaches us, that if a bonnet, rose-coloured, for example, give rise to a reflection of this colour on a complexion, the parts thus made rosy by the effect of contrast, themselves give rise to green tints, since the figure, while it receives rosy reflections, receives also diffused daylight.

518. To consider the real influence of the bonnet, we place three white plaster casts of the same model in a position equally illuminated by daylight; then observe them comparatively, after having clothed the middle cast with a white bonnet, and the two others with bonnets of which the colour of one is complementary to that of the other. *In this way we may satisfy ourselves that the influence of reflection in colouring a figure is very feeble, even when the bonnet is placed in the most favourable manner for observing the phenomenon.*

519. *Rose-coloured Bonnet.* — Rose colour reflected upon the skin is very feeble, except on the temples; wherever the rosy parts are contiguous to parts feebly

lighted by daylight, the latter will appear very lightly tinged with green.

520. *Green Bonnet.*—Green colour reflected upon the skin is very feeble, except on the temples; wherever the green parts are contiguous to parts feebly lighted by daylight, the latter will appear slightly rosy; the effect of green in colouring it rose, is greater than the effect of reflected rose in colouring it green.

521. *Yellow Bonnet.*—Yellow colour reflected upon the skin is very feeble, except on the temples; wherever the yellow parts are contiguous to parts feebly illuminated by daylight, the latter will appear very sensibly violet.

522. *Violet Bonnet.*—Violet colour reflected on the skin is very feeble, even on the temples; wherever the violet parts are contiguous to parts feebly illuminated by daylight, the latter will appear slightly yellow; but this coloration is very feeble, because the reflections of violet have it themselves.

523. *Sky-blue Bonnet.*—Blue colour reflected on the skin is very feeble, except on the temples; wherever the blue parts are contiguous to parts feebly illuminated by daylight, the latter will appear slightly orange.

524. *Orange Bonnet.*—Orange colour reflected on the skin is very feeble, except on the temples; wherever the parts are contiguous to parts feebly illuminated by daylight, the latter will appear slightly blue.

525. It is evident, then, from these experiments, that a coloured bonnet produces much more effect by virtue of contrast, arising from juxtaposition with the flesh-tints, than by the coloured reflections which it imparts to them.

526. Let us now see what advantage the painter can derive from the preceding observations, when he prescribes a bonnet to a model, belonging either to the light-haired or to the black-haired type.

FAIR-HAIRED TYPE.

527. A black bonnet with white feathers, with white rose or red, suits a fair complexion.

528. A *lustreless white bonnet* does not suit well with fair and rosy complexions. It is otherwise with bonnets of gauze, crape, or lace; they are suitable to all complexions. The white bonnet may have flowers, either white, rose, or particularly blue.

529. A *light blue bonnet* is particularly suitable to the light-haired type; it may be ornamented with white flowers, and in many cases with yellow and orange flowers, but not with rose or violet flowers.

530. A *green bonnet* is advantageous to fair or rosy complexions; it may be trimmed with white flowers, but preferably with rose.

531. A *rose-coloured bonnet* must not be too close to the skin; and if it is found that the hair does not produce sufficient separation, the distance from the rose colour may be increased by means of white, or green, which is preferable. A wreath of white flowers in the midst of their leaves has a good effect.

532. I shall not advise the use of a light or deep red bonnet, except when the painter desires to diminish too warm a tint in the complexion.

533 Finally, the painter should never prescribe either yellow or orange-coloured bonnets, and be very reserved in the use of violet.

TYPE WITH BLACK HAIR.

534. A *black bonnet* does not contrast so well with the general appearance of the type with black hair as with the other type, yet it may produce a good effect, and receive advantageously accessories of white, red, rose, orange, and yellow.

535. A *white bonnet* demands the same notice as that, concerning its use, in connexion with the blonde type (528), except that for brunettes it is better to give preference to accessories of red, rose, orange, and yellow, rather than of blue.

536. Bonnets *of rose-red or cherry-colour* are suitable for brunettes, when the hair separates, as much as possible, the bonnet from the complexion. White feathers accord well with red; and white flowers, with abundance of leaves, have a good effect with rose.

537. A *yellow bonnet* suits a brunette very well, and receives with advantage violet or blue accessories. The hair must always interpose between the complexion and the head-dress.

538. It is the same with bonnets of an *orange* colour, more or less broken, such as chamois, with which blue trimmings are eminently suitable.

539. A *green bonnet* is suitable to fair and light rosy complexions, rose-red or white flowers are preferable to all others.

540. A *blue bonnet* is only suitable to a fair or light-red complexion; nor can it be allied to such as have a tint of orange-brown. When it suits a brunette, it may take with advantage yellow or orange trimmings.

541. A *violet bonnet* is always unsuitable to every complexion, since there are none to which the addition

of yellow will be favourable. Yet, if we interpose between the violet and the skin, not only the hair, but also yellow accessories, a bonnet of this colour may become favourable.

542. Whenever the colour of a bonnet does not realize the intended effect, even when the complexion is separated from the head-dress by large masses of hair, it is advantageous to place between the latter and the bonnet certain accessories, such as ribbons, wreaths, and detached flowers, &c., of a colour complementary to that of the bonnet, as I have prescribed for the violet bonnet. The same colour must also be placed on the outside.

ON THE ASSORTMENT OF COLOURS IN THE DRESS OF WOMEN WITH COPPER-COLOURED SKINS.

543. The tint of the complexions of the women of the North American Indian races is too positive to induce them to endeavour to dissimulate, either by lowering its tone, or by neutralizing it. There is, then, no alternative but heightening it, for which purpose we must use draperies either of white or of blue strongly inclining to green, when the tint will become of a redder orange.

ON THE ASSORTMENT OF COLOURS IN THE DRESS OF WOMEN WITH BLACK OR OLIVE SKINS.

544. If I have prescribed the harmony of contrast of tone where the colour of the complexion is copper-red, there is a stronger reason for it when we have to drape olive or black skins ; we can then use either white or the most brilliant colours, as red, orange, and yellow. The consideration of contrast determines which one we

ought to choose in a particular case. If the complexion is intense black, dark olive, or greenish-black, red is preferable to every other colour; if the black is bluish, then orange is particularly suitable. Yellow will best accord with a violet-black.

545. *Results applicable to Portrait-painting.*

The tint may be heightened without leaving its scale :—

1. By a white drapery which heightens by contrast of tone.

2. By a drapery the colour of which is exactly the complementary of the tint, and of which the tone is not too high; such as perhaps a green drapery for a rosy complexion; or perhaps a blue drapery for the orange complexion of a blonde. The tint may be heightened by making it leave its scale :—

1. By a green drapery of a light tone upon an orange complexion.

2. By a blue drapery of a light tone upon a rosy complexion.

3. By a yellow, canary, or straw-coloured drapery, upon an orange complexion, of which the complementary violet neutralizes some of the yellow of the complexion, and heightens its rose.

546. *Note.*—The modifications resulting from the juxtaposition of parts diversely coloured are much more positive than those arising from reflection by one part upon another.

If the Painter wishes to dissimulate a Tint of the Complexion—

547. As above, he must distinguish two cases :—

1st, WHEN HE SEES THE COLOURS MODIFIED BY JUXTAPOSITION ONLY, *when the tint may be lowered without leaving its scale :—*

1. By a black drapery, which lowers it by contrast of tone. 2. By a drapery of the same scale as that of the tint, but of a much higher tone.

Such, perhaps, as a red drapery upon a rosy complexion; or, an orange drapery upon an orange-tinted complexion; or, the effect of a dark-green drapery on a complexion of a green tint.

2nd, *The tint may be lowered by making it leave its scale.*

1. By a green drapery of very dark tone, upon an orange complexion. 2. By a blue drapery of a dark tone, upon a rosy complexion. 3. By a very dark yellow drapery, upon a very pale orange complexion.

APPLICATIONS TO HORTICULTURE.

Section I.

548. The applications I propose to make are of two kinds: the one relating particularly to the arrangement of plants in gardens, according to the colour of the flowers; the other, to the method of distributing and planting ligneous plants in masses, which I suppose to have been previously planned. Doubtless, I need not have discussed the latter subject, but I have been led to it so naturally, and the rules which guided me are so positive and simple, that I have no doubt of their proving profitable to those of my readers who follow them in laying out plantations, &c.

The artist who conducts these operations is called a Gardener, or Landscape Gardener.

ON THE ART OF ARRANGING ORNAMENTAL PLANTS IN GARDENS SO AS TO DERIVE THE GREATEST POSSIBLE ADVANTAGE FROM THE COLOURS OF THEIR FLOWERS.

549. Among the pleasures afforded us by the cultivation of choice plants, there are few so intense as the sight of a collection of flowers, varied in colour, form, size, and position. It is probably because we admire the plants individually, and become attached to them on account of the pains they cost us, that we have hitherto so generally neglected to dispose them in such a manner as to produce the best possible effect when their flowers are seen collectively.

Thus, no defect is more common than that of the *proportion* in which flowers of similar colours are distributed in a garden. Sometimes the eye is struck by blue or white, sometimes it is dazzled by yellow. Add to this defect of proportion, the ill effect produced by placing together many species of flowers, which, although of the same colour, are not of the same tint: for instance, in spring we see the leopard's bane (*doronica*), of a brilliant golden yellow, side by side with the narcissus, which is of a pale greenish yellow; in autumn, the Indian pink beside the African marigold, dahlias of various reds grouped together, &c.

Such arrangements as these cause the eye, accustomed to appreciate the effects of contrast of colours, to feel sensations quite as disagreeable as those experienced by the musician whose ear is struck with discords.

550. Previously to my observations on simultaneous contrast, and the demonstration of the law which

governs it, it was impossible to prescribe rules which, by instructing horticulturists to place, with certainty of success, flowers in proximity whose colours reciprocally enhance each other, enabled them to avoid either the monotony resulting from the grouping of flowers of the same colour, or the disagreeable effect of a collection of flowers whose hues are mutually injurious.

ASSORTMENTS OF FLOWERS,

Where the Plants are apart.

551. The associations of flowers which relate to the harmonies of contrast of colour, are first, those with colours mutually complementary to each other; such as blue with orange, or yellow with violet. Rose or red flowers contrast with their own leaves.

552. White flowers accord more or less favourably with blue and orange flowers, already allied together; and perfectly with rose or red flowers, but not so well with yellow or violet flowers, already allied. White associates much less favourably when the latter is brighter or greener.

White flowers are the only ones that possess the advantage of heightening light tones of any colour, and of separating those whose colours are mutually injurious.

553. Yellow flowers, especially those which incline to orange, accord very well with blue ones.

Flowers of a yellow, more green than orange, have a very good effect with flowers of a red inclining to blue, rather than to orange.

Deep-red flowers accord well with deep-blue flowers.

Orange flowers are not misplaced near violet flowers.

ASSORTMENTS RELATING TO THE HARMONIES OF CONTRAST OF HUES.

554. It is so difficult to make associations of hues which will have a satisfactory effect, that I prescribe *in general* the mutual association of flowers whose colours belong to neighbouring scales.

We must then separate

Pink flowers from those that are either Scarlet or Crimson.

Orange „ „ Orange-yellow,

Yellow „ „ Greenish-yellow,

Blue „ „ Violet-blue.

I shall even go further in advising the separation of—

Red flowers from Orange, Blue or Pink from Violet.

Where the Plants are indiscriminately mixed.

555. Flowers which only present contrasts of hues and which spring from seeds sown thickly in borders, or in beds, will not have the same objection as when the roots are planted at a distance from each other.

556. Flowers, presenting a disagreeable contrast of hues, may still produce a good effect, when their assortment makes part of an arrangement of contrasts of colours, strongly opposed; in this case being no longer seen isolated, they become in a manner the element of a picture.

Section II.

ASSORTMENTS AS TO HARMONY OF ANALOGY.

557. I only reckon shrubs susceptible of this harmony; because only perennial plants afford to the

horticulturist a guarantee that the flowers of one year will be identical with those of the preceding; consequently, if we plant woody shrubs in such manner as to secure a regular gradation of tones, the successive annual flowerings will be constantly according to that order. We may apply this kind of arrangement to standard roses.

558. But I do not advise any one to attempt submitting annuals to this arrangement, because of the uncertainty that exists in the tones of their colour.

Harmonies of Analogy of Hues.

559. If I have spoken against the associations of *contrast* of hues (554), I am more inclined to speak against the associations of *analogy* of hues, always remembering the restrictions I have stated above (Section 1). We must not forget that my intention is to describe assortments, whose good effects are certain. Now the more the colours contrast, conformably to our law, the more latitude there will be, although the colours of individual flowers associated vary in tone and in hue.

560. An objection might be addressed to me *that the green of the leave , which serves as a ground to the flowers, destroys the effect of their contrast.* But it is not so; and to be convinced of it, it is sufficient to fix upon a screen of green silk, two kinds of flowers in conformity with the arrangement of the coloured bands (*pl.* 1. *fig.* 7), and to look at them from a distance of about ten paces; for when the eye is fixed on two well-defined objects simultaneously, surrounding objects, especially distant ones, produce but feeble impressions.

ON THE ART OF ASSORTING LIGNEOUS PLANTS IN GARDENS, SO AS TO DERIVE THE BEST POSSIBLE ADVANTAGE FROM THE COLOUR OF THEIR FOLIAGE.

561. If we consider trees and shrubs no longer under the relation of the colour of their flowers, but with regard to the manner in which we may employ their foliage in the decoration of gardens, we shall perceive that there is only a very small number of contrasts of scale and hue which we can realize while vegetation is active; yet in autumn, when plants, losing their leaves before falling, assume various colours, as red, rose, scarlet, orange, and yellow, these, by their brilliancy, recall the season of flowers. Most trees and shrubs present, in the summer season, only the green of their foliage; and, although this green varies in tone and hue, the differences are always trifling.

562. *Harmonies of Contrast.*—The most decided contrast of colour that we can establish between the leaves of ligneous plants, is that of green, with foliage nearest to red. But even the *purple beech* is more of a red brown than a dark *red*, properly so called, for the colour of leaves results from a mixture of red and green, which, according to the principle of mixing colours must produce black, if they are in suitable proportion, or a brown tone of the green or red scale, according as one or the other colour predominates. The contrast of hue is established by the assortment of a bluish green and a yellowish green of tones unequally high, by the contrast of a bluish-green brown with a yellowish light green, &c.

563. *Harmonies of Analogy.*—Nearly all the masses of various trees in our landscape gardens present certain

harmonies of hues mostly resulting from associations established according to considerations foreign to those of the assortment of foliage—an evident result, remembering (561) that the colours of the leaves of the greater part of plants are of green belonging to scales more or less allied, and of tones but little distant from each other.

(*a*) Harmonies of analogy of hues formed of allied tones belonging to neighbouring scales, are those which it is least difficult to obtain.

(*b*) Arrangements of foliage presenting a series of equidistant tones of the same scale of green.

ON THE DISTRIBUTION AND PLANTING OF TREES, ETC., IN MASSES.

564. The principal object of the two following chapters is to supply a deficiency in works on gardening as to the manner of distributing and planting trees in masses, &c., the outlines of which have been previously sketched conformably with precise rules. For authors say nothing on this subject, and the embarrassment of a landowner who wishes to plant an estate already planned out, is further increased by this circumstance, that, in the majority of cases, the author of the plan of the projected garden, after having defined the lines of the plantations, indicated the places where isolated trees must be placed, designated the kinds of trees which should constitute groups, and others which must enter into the formation of masses with trees and shrubs (which he does not generally indicate), leaves the care of planting and other details to ordinary gardeners.

Yet the distribution of trees and shrubs, however easy it may appear, in a piece of ground otherwise perfectly

planned, contributes more than is generally supposed to the pleasure of a landscape garden, and presents also more difficulties than to allow of its being effected in a satisfactory manner, when it is abandoned, as generally happens, to chance. In fact, if, at the end of a few years, we observe the greater part of masses planted as they frequently are, we shall be struck with defects which were not at first perceptible, because we were then under the influence of the pleasure we always experience at witnessing the development of plants which have been confided to a carefully prepared soil; and besides, there are some defects which are only perceptible after a certain time, such, for example, as that resulting—

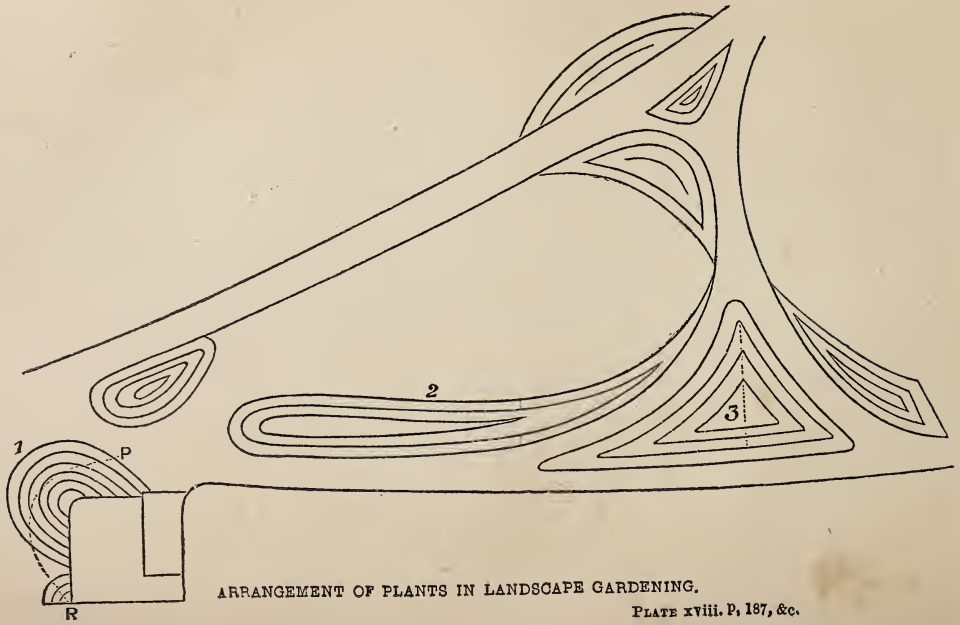
1. *From the plants being placed too near together.*

2. *From placing, in the front row, clumps which rise too high, or which lose their lower branches.* Such are the elder tree, and sumach.

565. It was after many years of lost enjoyments, through having planted without fixed rule, masses otherwise well designed in their contours, that I was led by my own experience to seek the means of avoiding similar errors in future. The rules I now give are not the result of reflection merely; they have been practised many years, and I am much deceived if those who observe them will not derive great facilities in their application, and experience from them a lively satisfaction.

566. I will now define several expressions employed to designate the different associations of plants which may form part of a landscape garden.

An assemblage of trees and shrubs, occupying a large space, is termed a *forest.* But in a landscape garden a similar assemblage, or that which has been arranged to present the appearance of a vast space, is called a *wood,*



ARRANGEMENT OF PLANTS IN LANDSCAPE GARDENING.

PLATE xviii. P. 187, &c.

if it is composed of trees and underwood; and a *park*, if it consists of trees only.

A collection of trees, shrubs, bushes, and underwood, is called a *grove;* when it consists only of trees, it is termed *a group of trees.*

There are *thickets* of shrubs, bushes, underwood, and of flowering herbaceous plants.

There are *thickets* formed of a single species of plants, and thickets formed of several species. The first are called *homogeneous*, and the second *heterogeneous*, or *varied.*

There are *isolated masses*, and *masses subordinated together.*

A small mass of flowers or shrubs, isolated, and of a circular or elliptical form, is called a *bed.*

CHAPTER I.

Of Lines of Plants.

567. I CALL a *line of plants*, plants placed at equal distances from each other, in straight or curved lines: these plants may be trees, shrubs, bushes, underwood, or flowering herbaceous plants.

568. A *line of plants* of sufficient extent, and of which the plants are close enough to conceal from view objects placed behind them, is called a *screen.*

All masses planted according to my method are composed of lines of plants parallel to each other; in other words, there is between two similar lines an equal distance throughout. But the distance between the first and the second may differ from the distance between

the second and the third, and so of the others. The result would be the same if the lines were closed curves, as, for instance, circles or ovals. The lines of plants are the elements of the masses.

Article I.

Of the Lines of Plants called Screens.

569. When we desire to conceal any object of considerable extent, we have recourse to a *screen of plants.* Whenever the extent of the land will not permit of the planting of several lines, constituting a mass, evergreens, such as thujas, almond-laurels, &c., are those to be preferred, succeeded by the hornbeam, lilac, privet, &c.

The most homogeneous screens, that is to say, those which are formed of a single species of plant, are preferable to all others for the object they are intended to fulfil ; and to avoid the monotony of a single species, we must have recourse to one which offers varieties. For example, a screen composed of violet and white lilacs, will possess at the same time the advantage of homogeneity for concealing what is behind it, and the advantage of variety of foliage ; the leaves of the violet lilac being of a less yellow-green than those of the white lilac. We may alternate one or more plants of violet lilac with one plant of white lilac.

Of Lines of Plants considered as Elements of Masses.

570. 1st. If the plants in the same line are not of the same species, it is essential that they do not differ too much from each other in respect to height.

2nd. Where a line happens to be entirely seen, the same species must be placed alternately.

3rd. We must avoid placing the same species in two neighbouring lines, when we would employ varied masses which are composed of several lines only.

RULE.— *When two lines of vegetation are planted to constitute a mass, in planting the first or exterior line, we must follow the rule indicated above* (570), *then go on planting the second line, in the same manner as the first, except that the stakes indicating the centre of vegetation must be placed chequer-wise relatively to the centre of vegetation of the first line.*

I will cite an example of a plantation of two lines intended to conceal a wall.

1st *Line.* 1. Almond-laurel. 2. Violet-lilac. 3. Laburnum. 4. Violet-lilac. 1*a*. Almond-laurel, &c.

2nd *Line.* 1. Clump of *prunus mahaleb.* 2. *Idem,* &c.

The distance between the clumps of the first line is four or five feet.

We may plant the first line in *screen,* and the second with trees larger than in the first ; we may also plant the second line with roots of *prunus mahaleb,* comprehending between two roots three or five clumps of the same species.

Of Homogeneous Masses.

571. The *homogeneous mass* includes only a single species of plant, because the intention of the gardener in forming it, is to produce an effect of *individuality.*

In the large French garden, designed by Le Notre, where the trees combine so effectually with the elements established by the architect, to prolong, so to speak, a

similar work, the symmetrical plantations are identical, and generally composed of trees of a single species.

572. Although homogeneous masses of trees have a good effect in a large composition, it is not so with those which are composed of a single species, or of a single variety of flower. They almost always present a monotonous aspect, especially if the latter have a definite extent; and if the species of plant of which they are composed is in flower only a part of the year, the defect of monotony will be greatly increased. Homogeneous masses of shrubs or of flowers are only suitable when they are in leaf or in flower during a great portion of the year; as their extent is small, and they serve simply as a bond of union between different parts more or less distant from each other.

Of Heterogeneous or Varied Masses.

573. I shall distinguish two cases—one where it is a *heterogeneous* or *varied* mass, isolated, intended to serve as an individual composed of distinct parts; and the other where it consists of many varied masses, allied ogether, and separated by paths, at least in some parts.

Isolated Masses.

If each line consists of only a single species, we must arrange the lines according to their size. For example—1. Lilacs. 2. Laburnum. 3. Judas trees.

574. *Heterogeneous or varied masses* placed together so as to form a whole, are generally separated from each other by glades, or unplanted intervals, but cultivated or sown in grass, or by paths. To make what follows thoroughly understood, I must point out the essential

difference that exists between landscape gardening and French (geometrical) gardening.

575. French gardening is regular and symmetrical, the paths are straight, and the eye is only impressed by objects slightly varied ; for when there are squares or straight borders, symmetry necessarily requires that the objects on one side be repeated on the other. The result is, that when the spectator has visited the principal points of this composition, which are never very numerous, he has seen everything it has to offer to his curiosity.

576. I will not say, with some writers, that landscape-gardening is conceived with an entirely different aim. The spectator who surveys a landscape garden, should be excited, so to speak, at every step, by the sight of various objects. The different points of view must be as numerous as possible, the paths must always, therefore, be traced, so that from no point can their whole extent be discovered. The plantations must be disposed so as to conceal the walls, fences, or other disagreeable ill-placed objects. They must allow the eye the greatest possible scope, at all the points the gardener wishes to be displayed ; and the views must vary with the different points successively observed.

577. To achieve this, it is evident that there must be no straight paths, but only curved ones. When paths pass between masses, the intervals between these masses must also permit to be seen groups of objects, which must form planes, skilfully prolonging the perspective, as far as possible. The masses, though varied, must nevertheless be allied together, so that neighbouring masses may harmonize as dependent parts of the same whole.

Article II.

578. *Harmony between masses distant from each other,* in which harmonies may be established by the same general means as they are between neighbouring masses. The foliage in the masses being much more abundant than the flowers, the shades of their greens will not differ so much from each other as the colours of their flowers; consequently, the distant masses, however varied in their foliage, are always in harmony of form and colour, if they have been planted according to our rules; and if they are composed solely of ligneous plants, which lose their leaves in winter, or solely of evergreens, which do not lose them; but in the opposite case, that is to say, when the masses are formed, the one of deciduous trees, and the other of evergreens, some remarks must be made relative to the conditions of harmony, which are the more necessary, as even the most studied landscape gardens generally err in this respect; for a clump or a mass of evergreens is almost always out of keeping in a large space where masses of deciduous trees are found. To remedy this defect we must multiply the groups or masses of evergreens, so as to establish between all of them this same correlation which is required by deciduous trees; but it is not necessary that the trees should occupy a space equal to that occupied by ordinary trees; it is sufficient if their forms recur at suitable intervals. In a word, for evergreens to produce a good effect, they must compose a whole, which unites or intercalates with the general effect of the masses of deciduous trees.

We may oppose allspice trees to pines, cedars to larches; different groups, composed of three or four trees only, suffice to harmonize a large space of ground occu-

pied with two or three groups composed of half a hundred similar trees.

579. *There are certain cases in which the want of either perspective or harmony requires, in a large mass, a line of trees which is neither concentric with its circumference, nor identical with the central line, if there be one; such, for example, as the line P. R., which is found in the masses* 1 *and* 2 (*Pl.* 18); *for if the planting of this line be correct, and according to the preceding principles, the trunks, which define it, beyond the concentric plantings, must be in the points of intersection of the line P. R., with the concentric lines, and the central line, if there be one; and the trunks must be as much as possible at equal distances from each other.*

Such a plan, always easy to make, will enable a landowner, when once his masses are planned, their concentric lines traced, and the species to be planted determined upon, to order from the nurseryman the exact number of each species he requires.

580. *After tracing the lines of plantations, and putting in the stakes to mark out the centre of the holes to be dug, we must draw upon grey paper lines representing those of the masses we intend to plant, taking as many equidistant points as there are stakes in the corresponding lines of plantation; we then fasten on these points wafers, or little circles of paper, of the colour of the flowers or the foliage of the plants, according to the desired effect.*

By this means we can judge of the harmony of the colours of flowers with the different hues of green composing the mass, and thus rectify any defect in the plan before we begin to plant.

The principles on which the preceding rules are founded are those of height, form, variety, facility of

development, and distinctness of view. Harmonious arrangement, with reference to these points, not being so exclusively the object of this work as the subject of colour, must be passed with this indication.

Contrast of Colours.

581. This principle, regarded generally, is included in the preceding, since a difference in colour will render plants distinct which have numerous analogies; but viewed specially, it produces among perfectly dissimilar plants, effects which can only be obtained from colour; and it is then that the principle of contrast is to be taken into consideration.

In the application of the law of contrast to the arrangement of flowers, we must never forget the difference between an assemblage forming a line of plants, and an assemblage of flowers belonging to plants of various heights, standing on different planes, so as to produce the effect of a picture. I have alluded to this before (551); for in a linear arrangement, for example, there is nothing more unpleasant than the blue flowers of the German iris, associated with the light violet of the lilac. But if we add to this association large tufts of *alyssum saxatile*, Persian iris, and red tulips, so that the golden yellow, white, and deep red, appear on one plane, and the deep blue and the light violets on a more distant plane, we shall obtain general effects of a most agreeable kind.

Repetition.

582. When a line of plants exhibits the repetition of the same species, and presents them regularly at the

same intervals, an effect is produced which, although very agreeable, is but little appreciated—for it is very rarely met with in gardens. It is especially the repetition of a similar arrangement of colours that is agreeable, and which recommends the observance of this principle.

Repetition of the same arrangement of plants of various kinds, and of course distinct to view, contributes greatly to prolong the extent either of an alley or of a mass; a similar general effect repeated a certain number of times becomes a standard, by means of which the eye judges the space to be greater than if it were bordered with individuals of the same species or variety equal in number to the former. This effect is carried to the utmost extent when the arrangement is composed of a certain number of tufts—five, for instance—placed between two trees, which rise above them, but not too high.

Repetition and distinctness of view concur in producing an agreeable effect.

583. *Variety*, like every other principle, should never be carried too far, and it is a great mistake to suppose that plantations made without design, and which thus it might seem must be extremely diversified, produce in this respect more effect than those which have been arranged according to the principles of distinct view, contrast, and repetition.

Whenever objects must have a certain superficial extent, we gain nothing by multiplying varieties of them. Thus, the repetition of an arrangement of three colours, including white or black, will generally be more agreeable than that of an arrangement of five colours.

Diversity of colours, pushed to the extreme, can only be permitted in a continuous border, or a bed of different

varieties of the same species of flowers, as a border of larkspur, china aster, or anemones; but, for flowering shrubs, we shall gain everything by not indefinitely multiplying their colour, in a view which the eye can embrace at once. And as with colours so with forms, which must not be too diversified in the same arrangement.

Symmetry.

584. We should deceive ourselves very much if we supposed the principle of symmetry to be excluded from landscape gardening. But, in order to perceive it or to put in practice, it is necessary to distinguish the *symmetry of similar parts,* and *the symmetry of parts merely corresponding.*

The former is that of two equal parts of one whole, as the two halves of a circle, of a square, of an equilateral or isosoceles triangle, &c.; while

Symmetry of parts merely corresponding, is that of two parts of the same whole, which, without being equal, have the same form, or nearly so; such are the two triangular parts of the Mass 3, Plate 18.

Or, that of two separate parts, more or less analogous in form, extent, or nature, which have a correspondence of position relatively to an intermediate object.

Or, that of two masses or groups of trees, or of a mass and a group of trees which are presented, the one to the left, the other to the right.

General Harmony.

585. In the general composition of a large landscape garden, it is not enough to have satisfied all these principles, if the different masses subordinated together,

which we shall now regard as individuals, as well as the various constructions of wood or of stone, are not combined by some harmonious relation suitable for satisfying the principles of *general* harmony. The isolated or subordinated masses near or distant from each other must be allied together by the same vegetable form or by analogous forms, or by the same arrangements of several species; or, lastly, by the same colours of flowers or of foliage. By the aid of similar means, we ally the house and other buildings to the different parts of the garden. When the neighbouring masses, especially those formed near buildings, are not sufficiently allied together, or the perspective of their concentric or median lines is not satisfactory, we have recourse to a different line of vegetation, which cuts the first and thus adds to the general harmony. Thus, as I have so strongly insisted, when we decide to plant evergreens in a landscape-garden, they must be distributed throughout the composition.

Sixth Division.

INTERVENTION OF THE PRECEDING PRINCIPLES IN THE JUDGMENT OF COLOURED OBJECTS, RELATIVELY TO THEIR COLOURS, CONSIDERED INDIVIDUALLY, AND TO THE MANNER IN WHICH THEY ARE ASSOCIATED.

586. In this division my object is purely critical. The positive conclusions at which I have arrived upon certain assortments of colours, so as to derive the best result from them under given circumstances, become rules, adapted to guide those who would judge a work of art in which such assortments occur. The generalizations established in the preceding chapters, with the

object of aiding the numerous artists who use colours, now critically considered, will serve as the basis of a conscientious and sound judgment upon the merit of any work in which these generalizations are concerned. They will, I trust, possess the double advantage of all the rules involved in the nature of such things; they guide the workman who does not disdain them, and they direct the critic who judges the work of which these rules govern some element. We cannot then refuse to recognise the utility of such an examination, both for artists and for the public, to whom they are more particularly addressed, in the hope that a clear demonstration of what is laudable or censurable will form such a public taste as, by preventing a reliance on first impressions, will lead to a sound judgment; and that we may not henceforth strive to enlist public suffrages by falling into unsuitable singularity, or by wandering from the truth.

587. If there exists a subject worthy of being studied critically on account of the frequency and variety of the cases it presents, it is unquestionably this; for whether we contemplate the works of nature or of art, their varied colours form one of the finest spectacles man is permitted to enjoy. Hence the desire of reproducing the coloured images of objects which excite our admiration or interest, has produced the art of painting. The imitation of the painter's works has given birth to tapestry, and carpets, and mosaics; while the necessity for economically multiplying designs has led to ornamental printing. The love of colour has also induced man to paint his dwelling and to dye his garments and household decorations.

588. The sight of colours, so simple a thing for the

greater part of mankind, is, according to some philosophers, a phenomenon entirely out of the domain of positive knowledge, inasmuch as they consider that it varies with the organization, and even the imagination, of individuals; consequently, they think that it cannot be inferred that, because one man sees an object in a certain way, another will see it in like manner under the same external circumstances. They believe that no generalization, deduced from observation, can direct the artist with certainty, either in the art of seeing his model or in faithfully reproducing a coloured image of it: they also think that no useful physiological generalization can arise from a profound study of the modifications his organs experience from the sight of the colours that bodies present to him.

I cannot admit that we ought to abstain from the study of a subject because it presents variable phenomena.

All those who are engaged in the study of the positive sciences, should inquire for some fact capable of illustrating the study of these phenomena.

589. I entered upon this study, not having spontaneously chosen it, but because it appeared to me indispensable before pretending to establish a sound judgment on the beauty of the dyer's colours. As soon as I felt the necessity for this study, in my capacity of Director of the Dyeing Department of the Royal Manufactories, my first care was to discover whether I saw colours as the generality of persons see them. I was soon perfectly convinced that I did, and not till then did I venture to make my researches the subjects of public lectures. These have been repeated before the students of the Polytechnic School. Certain questions addressed

to my auditors to satisfy me that they saw the things I put before their eyes as I saw them myself, have, in the majority of cases, always proved them to be so, and yet my demonstrations were given in the reception-hall at the Gobelins,—a place ill adapted for the exhibition of the phenomena of contrast to a large audience. Certain observations by myself, tested by a great number of persons in my laboratory, and afterwards publicly exhibited, form the subject of this book; all who repeat my experiments will discover whether my opinion is well-founded, or whether an opinion is correct which pretends that the sight of colours is not capable of giving a general positive result. Because some individuals have organs of sight so imperfect that they cannot distinguish green from red, or blue from grey, &c., must we write our treatises on optics without mentioning either red, green, or blue, and cast away these colours from the palette? Assuredly human nature is too limited to allow of our making such a sacrifice of our common organization to the infirmity of an individual.

590. In order to comprehend clearly how experiment and observation, after having disentangled the causes which exercise a determinate influence upon the sight of colours, led me to adopt the opinion that these phenomena are perfectly defined by the law of contrast and the conclusions therefrom, doubtless it will suffice to consider how

1. Our former ignorance respecting the different states of the eye, which, in seeing colours, give rise to the phenomena of simultaneous, successive, and mixed contrasts.

And our former ignorance respecting the definite

influence that the direct or diffused light of the sun exercises, according to its intensity, upon the colours of bodies, have led to the establishment of an opinion contrary to my own;—that is to say, the opinion that *the same colour appears so diversely to different persons, and even to the same person, that nothing general or precise can be deduced from the sight of coloured objects, with regard to their respective colours.*

2. To consider how the following have passively contributed to belief in this opinion.

The limited number of ideas we have generally about the modifications of coloured bodies, by their mutual mixtures; or in other terms, upon the colours resulting from these mixtures.

The want of a precise language to convey the impressions we receive from colours.

591. It is indisputable that if we are ignorant of the regularity with which the eye passes successively through stages, the extremes and the mean of which are very different, in viewing the colours which put the organ into the condition of perceiving the phenomenon of one of the three contrasts (77) we shall be led to consider the sight of colours as a very variable phenomenon, *while the successive stages through which the organ passes being once distinguished, the variations of the phenomenon become perfectly definite.*

592. If we are ignorant of the law of simultaneous contrast, we shall suppose that the same colour varies in tint according to the colour with which it may be associated; and if we are ignorant that contrast affects the tone as well as the colour, we cannot explain how two similar colours (for instance, blue and yellow at the

same depth of tone) will appear redder by juxtaposition; while, if the blue is very deep relatively to the yellow, it will appear black, rather than violet, and the yellow will appear more green than orange. Finally, if we are ignorant of the effect of the brightness which a complementary can give to a dull colour, we cannot explain the great difference there is between the effect that a red ground has upon imitative gilt ornaments, and the effect of the same ground upon metallic gilt ornaments (384).

593. Doubtless, also, if it be not known that in a complex object, the eye can only see clearly at the same moment a small number of parts and that the same part may appear to different eyes with different modifications, according as it is seen juxtaposed with one or another colour, as in the instance given (407).

594. We might know the regularity of the successive states of the eye during the sight of coloured objects, and the law of simultaneous contrast of colours, and yet, if we were ignorant of the influence of various degrees of intensity of light in varying the colour of bodies and in rendering the modifications of contrast more or less evident, we should be led to believe in an indefinite variation in the aspect of colours; but this variation is perfectly defined by the following remarks :—

If the direct light of the sun or diffused daylight illuminates a monochromous body unequally, the part most vividly lighted is modified as it would be if it received orange, and the modification appears the stronger the greater the difference of light on the parts (280): thus the more intense the light, the more it gilds the body it illumines; it is thus always easy to

foresee the effects of it when we know the result of the mixture of orange with various colours.

595. The phenomena of simultaneous contrast being less evident in a very vivid light than in a weaker light (63), it follows that if we disregarded the difference in the effects, we should greatly deceive ourselves in our appreciation of the phenomena of contrast of similar colours. Simultaneous contrast, which tends to make the differently coloured parts appear as distinct as possible, is carried to a maximum, precisely when the light being feeble, the eye requires the greatest contrast of colour to perceive distinctly the various parts upon which it is fixed.

596. We may perceive the modifications presented by bodies when lighted, and yet we may experience much difficulty in accounting for them, for want of knowing how to represent exactly the modifications which the coloured materials experience, in their colour, according as they receive light or white, shade or black; or according as they are mixed together. It is partly to make these modifications clearly known that I have designed the *chromatic hemisphere* (134, *et seq.*). In describing it, I have attached less importance to its material realization than to the rational principle upon which it depends. On looking at the lines of this diagram independently of all colouring, we understand how any colour is reduced by white, deepened by black, and broken by black and white, and how, by mixture with a pure colour, it produces hues. I shall add subsequently some new considerations on the gradations of colour made with coloured materials.

My object would not have been attained had not the chromatic hemisphere given me the means of

representing, by a simple nomenclature, the modifications which a colour undergoes by the addition of white and black, modifications which produce the *tones of its scale;* those which it receives from black yielding *broken scales,* and those resulting from the addition of a pure colour, produce scales which are *hues* of the first colour.

597. Finally, to the definitions which I have given of the words *tone, scale, hue, broken colours,* I must add the distinction of the associations of colours into *harmonies* of analogy, and *harmonies of contrast* (172).

I am convinced that all those who accept the small number of definitions I have given, will find much advantage from them in accounting for the effects of colours, and in expressing their views to others. By their aid it will be easy to notice relations which might have escaped observation, or which, in the absence of precise language, could not have been clearly communicated.

598. It would be ignoring a fact to attribute the opinion I have combated, exclusively to ignorance of what I have just recapitulated, or to believe, that in order to establish the contrary opinion, which I maintain, it is sufficient to dissipate this ignorance.

But I am satisfied with pointing out the error, without making the least pretension to overthrow it, otherwise than by stating what I believe to be the truth.

599. The study of the positive facts just reviewed, leads to a certainty in the view of colours which all may acquire who devote themselves to it. They will see how fruitful it is in applications, and that it is independent of every hypothesis, and that it would be impossible to obtain this result, if there did not commonly

exist among men an average organization of the eye, which permits them to perceive in similar circumstances the same modifications, but with varied intensity of perception.

600. Having noticed the series of principles upon which my book is founded, I next consider these facts under the three following relations :—

1. The certainty they give in judging of the colour of an object.

2. The certainty they give to our judgment in the various arts which address the eye by coloured materials.

3. The union they establish between the principles common to many arts, which speak to the eye as it were various languages, in employing different materials.

4. The influence that the disposition of the spectator's mind may have upon his judgment of a work of art.

Section I.

ON THE CONNEXION OF THE LAW OF SIMULTANEOUS CONTRAST OF COLOURS WITH THE JUDGMENT WE FORM UPON ALL COLOURED BODIES, UNDER THE RELATIONS OF THE RESPECTIVE BEAUTY OR PURITY OF THEIR COLOURS, AND OF THE EQUALITY OF THE DISTANCE OF THEIR TONES IF THESE BODIES BELONG TO THE SAME SCALE.

601. The most simple and general conclusion deduced from the law of contrast is certainly that which concerns the judgment we exercise, either by taste or profession, on a colour, whether presented by a coloured paper, a textile fabric, a glass, an enamel, a picture, &c. All those who have some experience in the matter consider

one condition as essential to be fulfilled to avoid error, namely, that the colour concerning which we have to determine be compared with another colour analogous to it. *If we are ignorant of the law of contrast, the result of this comparison is not exact, whenever the objects compared are not identical.* I now proceed to demonstrate this by examples adapted to the application of the principle spoken of. Further, a more remote consequence of the law affords the means of knowing whether the tones of a scale of wool or silk are equidistant.

ON THE COMPARISON OF TWO SAMPLES OF THE SAME COLOUR.

602. When we have to do with two patterns of any kind, which are related to the same colour, if there is no identity between the tints, we must take into account the contrast which exaggerates the difference; thus if the one be greenish-blue, it will make the other appear less green, or more indigo, or even more violet, than it really is; and, reciprocally, the first will appear greener than when viewed alone; the same with the reds, if one is more orange than the other, the latter will appear more purple, and the former more orange, than they really are.

INFLUENCE OF A SURROUNDING COLOUR UPON ONE COLOUR WHEN COMPARED WITH ANOTHER.

603. Since the contrast of colours which are not analogous, tends to improve and purify them, it is evident that whenever we would exercise a correct judgment upon the beauty of colours, after comparing them with the colours of objects analogous to the first, we must take into account the kind of work, and the manner

in which they are juxtaposed, if the objects compared are not the exact representation of the same subject. For, other things being equal, the same colours not blended, and which are not sufficiently analogous to injure each other, will certainly appear more beautiful disposed in contiguous bands than if each were seen on a ground which consisted of it exclusively, and which consequently produced only a single impression of colour upon the eye. Colours forming palms like those of Oriental shawls or patterns, as of Turkey carpets, produce a much greater effect than if they were shaded or blended, as they generally are in paintings. Consequently, for example, in comparing a stripe of crimson in a Cashmere shawl of various stripes with the crimson of a French shawl, we must destroy the contrast of colours by placing around it a piece of grey or white paper, cut out so as to allow this stripe only to be seen, when the parts compared will be submitted to the same influence from the surrounding objects.

604. So, when we compare the colours of old tapestries, pictures, &c., with colours recently dyed or painted. Time acts very unequally, not only on the different kinds of colours of dyed stuffs, but also upon the tones of the same scale. Thus, the deep tones of certain scales,—those of violet, for example,—fade, while the deep blues of the indigo-blue scale, the deep tones of madder, kermes, cochineal, are permanent. Also, the light tones of the same scale fade during a time which has no sensible effect in altering its deep tones. Whence the colours which have most resisted the destructive action of time, being more isolated from each other, as well as deeper and less blended, appear to have more brilliancy.

There are many pigments, as most of the lakes, which are in the same condition as compared with ultramarine, the oxides of iron, the blacks, &c.

On the Effect of Contrast upon the Browns and the Lights of most of the Scales of Wool and Silk employed in Tapestry and Carpets.

605. When we look at the whole effect of tones of most of the scales made use of in these manufactures, the phenomenon of contrast exaggerates the difference of colour observed between the extreme and the middle tones of the same scale. For instance, in the scale of indigo-blue, applied to silk, the lights are greenish, the browns are tinged violet, while the intermediate tones are blue; but the difference of green and violet at the two extremes is augmented by the effect of contrast. So in the scale of yellow, the light tones appear greener, and the browns redder, than they really are.

606. In speaking of a difference existing between the deep and the light tones of most of the scales of wool and silk, which is exaggerated by contrast, I will add some remarks relative to the gradations the dyer produces. This gradation is very seldom perfect, as the light tones are exactly represented to the eye by the colour taken at its normal tone, reduced by white. Thus, a compound which at the normal tone is pure yellow, or slightly tinged with orange, will, by reduction, produce light tones of a greenish-yellow. An orange-red compound upon silk or wool will yield light tones tinged violet-red. To obtain a correct gradation, we must in most cases add to the weak tones a new coloured material, adapted to neutralize or weaken the defect spoken of.

607. Many of the colouring matters used in painting produce the same result when reduced with white. I do not speak here of changes which may be the effect of chemical action; I allude only to those which result from an attenuation of the coloured material. For example, the normal tone of carmine is a much purer red than its light tones, which are evidently tinged with lilac. Ultramarine, so beautiful in itself, yields light tones which, with respect to the blue rays, appear to reflect more violet rays than the normal tone. In consequence of these facts, it is difficult to colour the chromatic diagram, because many trials must be made to obtain the modification of colour which yields the normal tone of a scale, by the addition of such coloured materials as will render the gradation correct.

MEANS AFFORDED BY CONTRAST FOR ASCERTAINING WHETHER THE TONES OF A SCALE OF COLOUR ARE EQUIDISTANT.

608. Contrast, which augments the difference existing between two tones of the same colour, affords the means of judging with greater certainty than could otherwise be done, whether the numerous tones of a scale are at the same distance from each other. Thus, if the tone 2, placed between 3 and 4, appears equal to the tone 1, it follows, if the tones are equidistant, that 3 placed between 4 and 5 will appear equal to 2; that 4 put between 5 and 6 will appear equal to 3, and so with the others. If the tones are too near together to yield this result, we must move them successively, not one degree, but two or three. This means of judging of the equality of distance that separates the tones of the same scale, is based upon the fact, that *it is easier to*

establish an equality than to estimate a difference between patterns of the same colour.

OF THE BINARY ASSOCIATIONS OF COLOURS, CRITICALLY CONSIDERED.

609. In order to sum up in few words the generalities which must serve as the bases of our judgment, not on one colour compared with another of the same sort, but on the associations of two colours, which any object whatever presents to our eyes, we must consider combinations both of complementary and non-complementary colours.

1st. *Combination of Complementary Colours.*

This is the only association where the colours mutually improve, strengthen, and purify each other without leaving their respective scales.

This case is so advantageous to the associated colours, that the combination is also satisfactory when the colours are not absolutely complementary; also when they are made dull with grey. I therefore prescribe the complementary association when we have recourse to the harmonies of contrast in painting, in tapestry, in the arrangement of coloured-glass windows, in the assortment of hangings with their borders, in that of stuffs for furniture and clothing; and, lastly, in the arrangement of flowers in our gardens.

2nd. *Combination of Non-complementary Colours.*

The product of this combination is distinguished from the preceding in this,—the complementary of the juxtaposed colours, differing from the other colour to which it is added, there must necessarily be a modification of hue in

the two colours, as well as a modification of tone, if they are not taken at the same height.

610. Juxtaposed non-complementary colours can *certainly* give rise to three different results :—

1. They may improve each other.
2. The one may be improved, the other may lose some of its beauty.
3. They may injure each other.

The greater the difference between the colours, the more favourable will the juxtaposition be to their mutual contrast; consequently, the more analogy they will have, and the more chances there are that the juxtaposition may injure their beauty.

1. *Two non-complementary colours improve each other by juxtaposition.*

611. Yellow and blue are so dissimilar, that their contrast is always sufficiently great for their juxtaposition to be favourable, although the juxtaposed colours belong to different scales of yellow and blue.

2. *One colour juxtaposed with another which is not its complementary, may be improved, while the latter may be injured.*

A blue, which is improved by a yellow, being placed beside a violet (blue rather than red) may lose some of its beauty, by becoming greenish; while the orange it adds to the violet, neutralizing its excess of blue, rather improves than injures it.

3. *Two non-complementary colours may injure each other.*

A violet and a blue are reciprocally injurious, when the first greens the second, and the latter neutralizes sufficient of the blue in the violet to make it appear *faded.*

It might also happen that although the colours juxtaposed be modified, neither gaining nor losing in beauty, that the one may gain without the other losing; lastly, that the one may neither gain nor lose, while the other loses.

612. *In the association of two colours of equal tone, the depth of the tone may have some influence on the beauty of the association.*

For example, a deep indigo-blue and an equally deep red, gain by juxtaposition; the first, by losing some violet, will become a pure blue, the second, in acquiring orange, will become brighter. If we take light tones of the same scales, it may happen that the blue will become too green to be good as a blue, and that the red, acquiring orange, will be too yellow to be a pure red.

613. *In the association of two coloured objects of tones very distant from each other, belonging to the same scale, or to scales more or less allied, the contrast of tone may have a favourable influence upon the beauty of the light tone;* because, in fact, if the latter is not a pure colour, its juxtaposition with the deep tone, upon the whole brightening it, will purify the colour from whatever grey it may have.

614. It is very necessary for the correction of our judgment of these principles on the binary associations of colours, not to lose sight of all that precedes, concerning colours that are "dead," or without gloss, and that their combination be considered independently of the form of the objects presenting them, for the twofold reason, that *the glossiness of the coloured surfaces, and the form of the bodies which these surfaces bound,* may modify the effect of two associated colours; consequently, the analysis I have made of the optical

effects of colours would be incomplete without speaking of the possible influence of these causes.

Influence of Gloss taken into consideration in the Effect of Contrast of two Colours.

615. The optical product of the juxtaposition of contrasted flat colours is composed of two effects :—1. The effect which arises from each of the juxtaposed colours, by receiving the complementary of the colour contiguous to it, is thus strengthened or tinged agreeably, independently of any augmentation of gloss. 2. The effect arising from gloss in the two juxtaposed colours. Here it may be remarked that associations which I have not prescribed, such as red with violet, or blue with violet, have a fine effect in the plumage of certain birds and butterflies ; for, in these natural associations, the effect arising from the addition of the complementaries to each, which would injure the *flat* colours, is entirely insensible in surfaces which acquire *metallic brilliancy* from their organic structure. Finally, I shall add, that it would be necessary, before raising the objection, to demonstrate that the same red, associated with green, the same violet associated with yellow, and the same blue associated with orange, equally glossy, would be less effective than in natural assortments.

Influence of Form taken into consideration in the Effect of Contrast of two Colours.

616. Elegance of form, the arrangement of the parts, their symmetry, the effects of light and shade, and the association of ideas which may connect this form with an agreeable recollection, will prevent the perception of the ill effect of two associated colours, even when not

glossy. Thus, for example, in flowers, combinations, which would not produce a good effect upon two plain surfaces, are very beautiful. For example, the flower of the sweet pea, which has the combination of red and violet.

617. The critic must be directed by the considerations here summed up :—

1. The kind of association : the greater the difference between the colours, the more they beautify each other; and, the less difference there is, the more they will tend to injure one another.
2. The equality in depth of tone.
3. The difference of tone, the one being deep, the other light.
4. The glossiness of the surfaces which reflect the colours to the eye.
5. The form of the coloured body.

OF THE COMPLEX ASSOCIATIONS OF COLOURS, REVIEWED CRITICALLY.

618. It is evident that the rules prescribed for judging of a colour, and the associations of two colours, in an absolute manner, must serve for judging as to the colours of an association, however complex it may be. We shall consider the masses of colours which are upon the same plane, the extent which each occupies, and the harmony which unites them. On submitting to a similar examination the colours on the other planes, we can then look at the colours of the latter. The critic who is well satisfied with seeing clearly at the same time, only a very small number of the objects

that a picture presents to him and who is also accustomed to examine a coloured composition in this manner, is in the position of a person who reads in succession writing on the same side of a sheet of paper; one series of lines crossing the first at right angles, and the third composed of lines running diagonally across the paper. The critic must review the *ensemble* of the picture as to its colours, and then, being attentive to their particular and general associations, he will be in a condition to enter into the thought of the painter, and to see whether he has employed the most suitable harmonies to express it. Although it is easier to form with opposed colours than with neighbouring colours binary assortments favourable to the associated colours, yet, when a great number of pure and brilliant colours are employed, it is more difficult to harmonize them than if we produced the effect with a small number of colours, which would involve only the harmony of analogy, or that of scale, or of hue.

619. Although harmony of contrast most favourably causes two colours to impart value to each other, yet, when we desire to derive the greatest advantage from a union of numerous brilliant colours in any work—a picture, for instance,—this diversity presents some difficulties in the general harmony, which a smaller number of colours, and especially of brilliant colours, would not present. It is, therefore, evident that, if we compare two effective pictures, well adapted to be judged under the relation of colour (other things being equal), the one which presents more harmony of contrast of colour will have the greater merit, on account of the difficulty overcome in the employment of the colours;

but it must not be inferred that the painter of the other picture is not a colourist; for the art of colouring is composed of several elements, and the talent of opposing pure colours to each other, is only one of these elements.

620. Let us now consider the relations existing between the subjects of painting and the harmonies they admit of. We know that the more pictures address the eye by numerous contrasts, the more difficulty the spectator experiences in fixing his attention; especially if the colours are pure, varied, and skilfully distributed upon canvas. It results, therefore, from this, that these colours, being much more vivid than the flesh tints, the painter who wishes that his idea should be found in the expression of his figures, and who, deeming this part of his art superior to the rest, is convinced that the eyes of most people ignorant of the art of seeing, being carried away by their first impressions, are incapable of returning from these to receive others;—the painter, I say, who knows all this, and is conscious of his power, will be restrained in the use of harmonies of contrast, and prodigal of the harmonies of analogy. But he will not derive advantage from these harmonies, especially in a subject covering a vast space filled with human figures, as the "Last Judgment" of M. Angelo, unless he avoids confusion by correct drawing, by a distribution of the figures in groups, skilfully distributed over the canvas, so that they may cover it almost equally, yet without cold symmetry. The eye of the spectator must embrace all these groups easily, and seize the respective positions; while in looking into one of them he must discover a variety which will invite his attention to other groups.

621. The painter who fails to gain the effects of the physiognomies, &c., in having recourse to the harmonies of analogy, will not have the same advantage in fixing general attention, as the painter who employs the harmonies of contrast.

The harmonies of contrast of colour are especially applicable to scenes (illumined by a too vivid light), representing fêtes, ceremonies, &c., which may be sober without being mournful; they are also applicable to large subjects, comprising groups of men animated with various passions.

Hence, the critic must never compare the colouring of two large compositions without taking into account the difference which may exist in the suitableness of each subject with one kind of harmony rather than with the other.

Painting in Flat Tints.

622. To apply painting in flat tints to historical, portrait, and landscape painting—in a word, to the imitation of any object of which we can produce a faithful representation, would be going back to the infancy of art; but to abandon it to practise exclusively the system of painting where all the modifications of light are reproduced according to the rules of chiaro-'scuro, would be an error which can be demonstrated beyond question.

1. That, in every instance in which a picture must be placed at such a distance from the spectator that the details of chiaro-'scuro will not be visible, we must have recourse to flat tints,—not neglecting, however, to use masses of light and shade adapted to give relief, if it is considered suitable.

2. That, in every case where the picture is necessary

to the decoration of an object, flat tints are preferable to chiaro-'scuro, because the use of the object almost always prevents the picture which ornaments it from being clearly seen under all circumstances. Thus painting in flat tints is preferable to the other—

For ornamenting boxes, tables, screens, which, from the various positions their use requires, only allow to be seen a part of the pictures which decorate them; or, if the paintings are entirely visible, as those of a screen, they will be presented relatively to the daylight in a manner quite different from each other, on account of these various positions of their parts;

For decorating curved surfaces, as those of vases, the surfaces of which are never plain.

3. That the qualities peculiar to painting in flat tints are:—

Purity of outline;

Regularity and elegance of forms;

Beautiful colours properly assorted.

Whenever suitable, the most vivid and the most contrasting colours may be advantageously employed.

Simplicity in the whole, so as to render clear and distinct view easy.

OF THE ARTS WHICH ADDRESS THE EYE BY EMPLOYING COLOURED MATERIALS OF A DEFINITE SIZE, CONSIDERED RELATIVELY TO THE PHYSICAL CONDITION OF THESE MATERIALS, AND TO THE PECULIARITY OF THE ART IN WHICH THEY ARE EMPLOYED.

623. If we examine paintings with sufficiently powerful magnifiers, we shall see that the coloured material, far from being continuous in all its parts, is in separate

particles, and consequently, if the naked eye does not perceive them separately, it is because they are too small. In fact, the coloured threads (elements of tapestries and carpets), and rigid coloured prisms (elements of mosaics), which are visible to the naked eye, may be reduced to such a state of division, and so mixed and combined, that at the distance from which we view them united they appear as a uniform coloured surface—as if painted; whence the possibility of making, with these elements, works which correspond to those painted in chiaro-'scuro; but it will be easier to execute such as correspond with flat tints.

TAPESTRIES, CARPETS, MOSAICS, AND COLOURED GLASS WINDOWS, CORRESPONDING TO PAINTINGS IN CHIARO-'SCURO.

Tapestries with Human Figures.

624. Tapestries with human figures derive their origin from the taste of mankind for painting. They had adorned churches, palaces, and castles, before they appeared in simple dwellings.

From the filamentous condition of the elements constituting them, their size, the direction the weaver gives them in twisting the weft upon each thread of the warp, results a coloured image presenting two systems of lines cutting each other at right angles. From this structure it results, that a tapestry will not produce the effect of a painting (the surface of which is entirely uniform), if the spectator does not view it from a point sufficiently distant; so that, these lines ceasing to be visible, the delineation which separates each part of the design from the contiguous parts, will appear like the delineations of

a painting, as much so as the indentations of the outlines which are oblique to the weft will permit. Hence *the objects represented by it must be large, of various colours, forming harmonies of contrast rather than harmonies of analogy.*

625. Every model which does not fulfil the previous conditions is bad, and as, in pictures which have not been painted with the intention of being reproduced in tapestry, it is difficult to meet with the union of pure outline with harmonies of colours sufficiently numerous and contrasted, it follows that what would be very advantageous to the art, is the execution of pictures intended to serve exclusively as models, painted broadly, so as to resemble, in some degree, painting in flat tints.

The weaver not having, at least at present, models painted on this system, has to make, not only, as we say, *a translation*, but also *a free and not a literal translation*, of the model; and it is this, in my opinion, which distinguishes the artist-weaver from the mere *workman*. Far from contending, then, with painting, the weaver, on the contrary, must study the circumstances in which he should yield in the struggle, so that he may avoid the difficulties with the means at his disposal; and when, especially, he must deviate from his model.

Tapestries for Furniture.

626. The preceding consideration respecting the size of objects that figured tapestries should reproduce, is not applicable to tapestry for furniture, seeing that the threads of the warp produce lines which, far from being disagreeable, are often imitated by the paperstainer.

627. These fabrics being intended for chairs, couches,

curtains, screens, &c., the painter charged with composing designs for this class of works, must never forget that tapestries may occupy dark places, where they are imperfectly and often indistinctly seen ; consequently he must select simple and elegant forms, in harmony of colour with the tapestry, &c., in the apartment. These models, even more than those for tapestries with human figures, must assimilate with painting in flat tints.

From among the facts I could quote to support this opinion, I shall select the following. There was a deep rose-red curtain, the centre representing a large bouquet of flowers of various colours, framed, as it were, in a garland of white roses. The artist had painted the model under the idea of executing this garland with silver thread ; but this metal being objectionable, on account of its tarnishing by various exhalations, preference was given to white and grey silk, imitating the tones yielded by a silver object in relief. An experiment showed that it could not be attained by these means, because the contrast of the ground made all the half-tints appear *green-grey*, and these in their turn made the lights appear rusty-pink, in consequence of the greenish colour of their contrast. This annoyance being communicated to me, I advised M. Deyrolle, in reproducing the model, to make use of only three light tones of the rose scale in silk, and a white linen thread. By this means I expected that the complementary of the ground, neutralizing the rose, would produce a greyish half-tint, well adapted to set off the white. The result was such as I had foreseen. A second copy, made with a mixture of the light tones of the pure rose scale, slightly broken, gave an image less white, less *silvery* than the preceding ; or, in other terms, appearing a little

greenish when compared with the first, and more harmonious. It resembled the effect obtained with rose-red under lace or tulle, which permits little of the ground to be seen. This example indicates the means of executing white designs upon any kind of ground.

Savonnerie Carpets.

628. Carpets are larger than the tapestries for hangings; on the other hand, being liable from their position to be soiled by the feet, and to receive furniture on some part, they are in a less favourable condition than tapestries for being distinctly seen. This, then, is one reason why we should choose models, of design and colour adapted to the circumstances necessitated by custom, and in harmony with what is around.

Mosaics.

629. Mosaics being composed of minute prisms, and of materials susceptible of polish, we can rigorously copy very small objects, and, consequently, approach much nearer to painting in chiaro-'scuro than by employing threads. But to arrive at this result, without being unfaithful to the peculiarity of the art, the materials must be sufficiently solid, and joined together so intimately as to resist the agencies which would destroy a painting; for if this end be not attained, we cannot see the use of copying a picture in mosaic. So that to justify the production of such works, we must make sure that, in the situations in which they are placed, they will resist the agents which would destroy the works of the painter.

Windows of Coloured Glass.

630. A work executed in small prisms of transparent coloured glass, in imitation of painting in chiaro-'scuro, would be a true transparent mosaic. I do not know that such an imitation has ever been executed.

All the coloured glass windows which I have spoken of as decorations of Gothic churches, are composed exclusively of small pieces of glass of uniform colour, united by strips of lead or of iron ; or altogether of these small pieces of glass, and of glass upon which we have applied with a pencil materials which afterwards have been vitrified: we can only entertain the question of the latter in this article.

We may propose two different objects in the production of these windows: either the coloured pieces are altogether secondary in the work, that is to say, occupying a much smaller extent of surface than the others, they do not attain to the perfection of painting,—such is the case with the greater part of the windows of large Gothic churches,—or else these pieces are the principal parts, which, predominating over the others, we attach great importance to the design and to the gradation of tints ; such are several windows executed at the Royal Manufactory at Sèvres. The more such works resemble the preceding windows by the effect of their variety, brilliancy, and apposition of colours, the more they attain the object they must essentially fulfil.

Tapestries, Carpets, Mosaics, and Coloured-Glass Windows, corresponding to Painting in Flat Tints.—Tapestries with Human Figures.

631. Although I have advised for tapestry models executed on the system of painting in chiaro-'scuro to resemble painting in flat tints, yet I shall not recommend taking the models entirely according to this latter system.

Tapestry for Furniture.

It is quite otherwise with patterns of tapestry for furniture. I believe that we can make some very beautiful works by copying patterns in flat tints; and that, in the decoration of large apartments, we may obtain an excellent effect from this kind of tapestry. I believe, also, that it would be more suitable for forming part of a general system of decoration, than the kind of tapestry of which I have spoken in the preceding article. Moreover, it is more favourable than the latter to the splendour of the colours.

The preceding observations are entirely applicable to the production of carpets.

Mosaics.

632. Mosaics being composed of more rigid and coherent coloured materials than are employed in the arts which combine coloured materials, I believe that it will be requisite, in judging works of this sort, to consider the power of the materials to resist the effects of friction, water, and atmospheric agents as essential qualities; the colour will follow.

Windows of Coloured Glass.

633. Considering coloured-glass windows under the threefold relation of transmitting light into large Gothic churches, of their accordance with the decoration of objects consecrated to the rites of the Church, of transmitting a coloured light entirely in unison with the religious sentiments, I prescribe a uniform colour for rose windows and straight windows with circular or pointed tops, the smallest number of colours in the glass, glass of uniform colour predominating over the other to produce the best possible effects of colour.

OF THE DISPOSITION OF THE MIND OF THE SPECTATOR IN RESPECT TO THE JUDGMENT HE FORMS OF AN OBJECT OF ART WHICH ATTRACTS HIS EYE.

634. It is not enough to have indicated the rules to be followed and the principles to be observed in the production of effects, and the judgment of them in relation to art; we must also speak of the disposition of the spectator for receiving, more or less intensely, the impression of those effects. To take no notice of this disposition would be to display ignorance of human nature, and of the utility of the examination, which should be impartially pursued also by the critic, who may exaggerate blame as well as praise.

Without examining the influence that the passions exercise in opinions formed on works of art, I will say a few words upon a predisposition which may be remarked in a portion of the public, at least at certain epochs, and which has its source in man's vanity; then

I will point out the part which the association of ideas performs in our adoption of opinions.

635. When a body of painters, called a *school*, has produced some *chefs-d'œuvre*, it frequently happens that a great number of mediocre works, executed under the pretence of continuing them, far from being favourable, are, with a portion of the public, injurious to them, on account of the monotony resulting from an imitation, more or less servile, of their form, colour, and even of their subjects. The public, under these circumstances, are ready to applaud any innovation that will excite emotions which it has not for some time found in contemporary painting, and it is then that amongst the public, voices are raised against great works, which have nothing in common with the tame imitations of them produced by mediocrity. Indeed, there comes an epoch when innovation, losing the only advantage it possessed of presenting to the eye images differing from those which it had been a long time accustomed to see, the public returns to the *chefs-d'œuvre*, and forgets all the feeble works composed in imitation of them by feeble pupils; and we will add that, if works *professing to be of the new school*, and endowed with undeniable merit, should exist, they would, in the estimation of connoisseurs, take the places they ought to occupy; whilst those which had arrested attention by innovation only, would disappear for ever.

636. Finally, to notice the effect which associations of ideas have on our opinions. For example, he who arrives at Versailles, full of admiration for the age of Louis XIV., repeoples the gardens with all the great men that have frequented them, and his thoughts recurring to the *fêtes* given by an elegant and polished court,

the admiration of Europe, he will judge the work of Lenôtre more favourably than he who, without being hostile to the *grand siècle*, will see nothing but a garden subordinate to a palace. And the Christian who associates in his mind the architectural form, the brilliancy of the coloured glass, and the religious ceremonies of the Gothic Church, all which he has venerated from his childhood, will be in a disposition to prefer the cathedral of Cologne to that of St. Peter's at Rome; while the latter would be associated with the profoundest veneration in the mind of a Christian of Rome.

ON THE COLOURS OF MILITARY UNIFORMS.

The following section, in which are described the advantages of contrast with regard to the heightening and purifying of the colour of cloths for dress, properly belongs to the chapters on clothing, pp. 165, &c. But, as in the present day, the colours of men's ordinary dress are not usually very various or strongly contrasted, this portion of the work has a more special application to military uniforms; the choice of colours being regulated by the principles laid down and exemplified throughout the work.

And, independently of economical considerations, the selection and arrangement of colours for military uniforms demand investigation as to the prominence or

obscurity resulting from their combination, as well as to their æsthetical effect.

Of Uniforms composed of Complementary Colours.

By the law of contrast, red and green of similar tone in the same uniform, will heighten each other. Let us suppose the augmentation of colour by juxtaposition to equal one-tenth, its optical effect may be stated as $1\frac{1}{10}$. If a single coloured uniform, by one year's wear lose one-tenth of its colour, it is clear that the uniform of the above two colours after being worn the same time will be as effective as the single colour was originally.

Similar reasoning may be applied to all colours that are complementary, as orange and blue, violet and greenish yellow, &c.; it is necessary however to take into consideration their difference of tone.

Among colours which are not complementary, but which produce an agreeable contrast, may be mentioned particularly blue and yellow, blue and scarlet, green and yellow.

Blue and Yellow.—These two colours harmonize well, the blue imparting to the yellow an orange tint so much the deeper as the tone of the blue is raised, while the yellow communicates to the blue a beautiful tint of violet, or if the blue have any unpleasant greenish tint the yellow will neutralize it. If, however, there be a great difference in the tone of the two colours, contrast arising from this difference might destroy the effect of the contrast of colours; so that a deep blue might appear black or less violet, while the yellow, being enfeebled, might seem greenish.

Blue and Scarlet.—Deep blue and scarlet make a

beautiful assortment, the blue giving fire to the scarlet; the latter rendering the blue more pure. There is no doubt that for effect a clearer blue and a fresh orange would be preferable, if there be no white in the uniform.

Green and Yellow.—This combination pleases by its gaiety, which suits cavalry of the line. But the green should be yellower and clearer than that which associates well with red; for the twofold reason that the yellow, by neutralizing a portion of the yellow in the green, raises the colour of the blue, and consequently lessens the brilliancy of the green. Besides, this effect tends constantly to increase, as the yellow of the green fades sooner than its blue. On the other hand, the yellow cloth receiving red from the green, must not be taken too deep. This case furnishes a good example of the economical advantage of contrasts of colour generally; and it will be seen that good arrangements are so much more difficult to make, as we depart from the contrast of complementary colour.

Of a single Colour and White.

We must refer to our preceding observations with respect to the juxtaposition of white with colours (178) to reason upon these combinations in uniforms. Colours are heightened, their complementaries are added to the white, and effects are produced which are so much the more perceptible as the colours are less raised in tone. If the white is rusty the juxtaposition of blue will heighten its tint; violet placed beside it will clear it, rendering it yellow; green will increase its redness; yellow, and especially orange yellow, will enfeeble it.

A white uniform has a good effect, not only when white pantaloons are worn with a white coat, or with

facings, collar, &c. of white to a light-coloured coat; but it has a good effect also with light trousers; for instance, light blue and white coat, or collar and facings. White trousers also do well with a uni-coloured coat.

Bi-coloured Uniforms with White.

White produces a really good effect only with blue and orange, or blue and red, being much inferior with green and yellow, or blue and yellow. It is, however, very suitable for trousers, with any combination of two agreeable colours in the coat. Nothing more clearly demonstrates the advantage of blue or red with white, than the difference between a uniform of deep red and blue without white, and the same with white facings and buff-skin belt, &c.

Bi-coloured Uniforms with Black.

Black enters advantageously into the composition of many uniforms of two luminous colours, such as scarlet, orange, yellow, or bright green. A scarlet coat with facings of greenish, rather than orange, yellow, is perfectly adapted to black trousers. And black trousers may be associated with sombre colours in the other parts of the dress for a uniform which is not to be conspicuous or seen far off.

Uniform of more than two Colours, not comprising Black and White.

Although three colours may be combined without producing a bad effect, yet I give the preference to a bi-coloured dress with a mixture of black and white. And I may remark here that if the sight of several colours be more agreeable than of one only, there are

disadvantages in the union of many colours, especially if the colours are scattered on different objects, or several parts of the same object.

Uniform of several Shades of the same Colour.

Strictly speaking, it is possible to make an agreeable arrangement of colours belonging to the same or neighbouring scales; yet the difficulty of doing this, and the chances of success where there is a contrast of colour, determine me to reject the former, at least whenever brilliant colours are employed; but for sombre-coloured arrangements they may be employed. In proof of this, I will mention the bad effect of those French uniforms, in which there is a juxtaposition of madder and of cochineal reds.

Uniforms of two Tones of the same Scale.

This arrangement is not successful, for the lighter loses its colour, and if the deep tone acquire it, it is scarcely ever advantageous.* We will not therefore dwell upon it.

Of a Mono-coloured Uniform.

If uniforms of contrasted colours are advantageous in an economical point of view, if light coloured uniforms present advantages when it is desirable to exhibit to the enemy the numbers who oppose him, there are

* It must be remembered that Chevreul speaks here of colours exclusively as to their optical effect, and that the very objection which he states to such an arrangement of colours, would be one of its best recommendations to the advocates of an obscure, in preference to a conspicuous uniform, as for Rifle Corps.

many cases in which the object is rather to conceal and dissimulate their presence, than to display them. Well, for such purposes, or if there is to be established a sort of hierarchy among the various corps, by means of dress, we may have recourse to a single and sombre-coloured uniform.

The Influence of Superficial Extent upon Combinations of Colours in Polychromous Uniforms.

I have already several times had occasion to speak of the influence of extent in the proportions of colours even when well associated, I must now add that it is not enough merely to make a satisfactory combination, but that *to produce the best results from colours, they must be employed in suitable respective proportions.*

When a colour is in feeble proportion to another, it must be spread as equally as possible throughout the garment; as, for example, in the uniform of the artillery, blue and scarlet; the latter, although far less in superficial proportion, produces a very good effect, because it is distributed throughout the uniform.

In a polychromous uniform, where one colour is found in several garments, we must avoid confounding the colour with the superposed or contiguous parts, so as to make one portion seem to belong to another. For example, the French regiments wear red trousers, with a blue coat turned up with the same red as the trousers. What happens? At a certain distance the one seems a part of the other, and the blue coat-tails seem far too narrow. It would be easy to remedy this defect by putting blue with red braid for the portions of the coat turned up.

From the above, I admit the two following prin-

ciples :—1. Whenever the coat and trousers are of the same colour, and there is a second colour put upon the coat in feeble proportion, it must be repeated on the trousers, in a broad band, if the soldier wear boots, or in a braid, if he wear shoes. 2. Whenever the trousers are not of the colour which forms the basis of the coat, but of facings or distinctive parts, a band or simple braid of the main colour of the coat will restore to the trousers their distinctness.

These remarks show how desirable it is that the choice o. colours, and especially of those which are distinctive of regiments or corps, should be the result of rules, established by their adaptation to the duties to be rendered by the regiments wearing them.

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LONDON:
SAVILL AND EDWARDS, PRINTERS, CHANDOS-STREET,
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